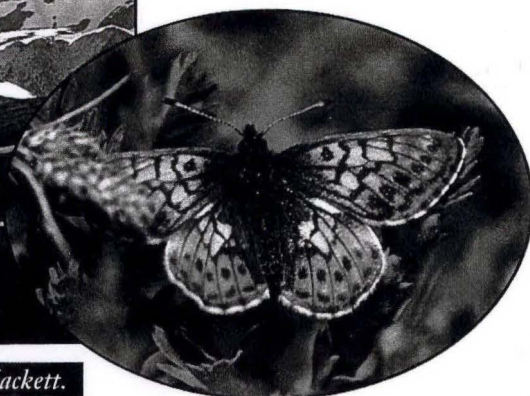


# POPULATION MONITORING AND INVENTORY OF THE UNCOMPAHGRE FRITILLARY (*Boloria acrocnema*) 1995 field report



*Uncompahgre Fritillary and its habitat, Uncompahgre Peak. Photo by Mundy Hackett.*

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## SUMMARY

In 1995, the Colorado Natural Heritage Program was contracted to continue the monitoring and search for the endangered Uncompahgre fritillary butterfly (*Boloria acrocnema*). Continuing seventeen years of prior research, our objective was to provide a yearly estimate of the size of known populations that would be comparable to those from past years, and to conduct a systematic effort to verify questionable occurrences and locate additional colonies.

This endangered species is found only at very high elevations in moist alpine meadows, and only in the San Juan Mountains of southwest Colorado. Prior to 1995, only three colonies were known to exist and the status of these populations has approached extinction.

Although the unusually cold and wet spring of 1995 provided many logistical problems for us, it was a good year for the butterfly. All three known colonies continued a four-year increase in numbers, and estimates for the 1995 broods are the highest recorded for this species. Three additional colonies were confirmed to support significant numbers as well.

Following our work in 1995, a total of six colonies of the Uncompahgre fritillary have been located in the San Juan Mountains. Populations at these sites vary in size, but the largest and best studied populations fared well in 1995, reaching record abundance.

While this is fortunate news, this species should still be considered dangerously near extinction. Significant threats remain and the cause of nearly terminal population declines has not been determined.

Recommendations, also included in the Uncompahgre Fritillary Butterfly Recovery Plan (Fish and Wildlife 1994), include:

- Effective protection and management of the known colonies and the larger areas that support them. Past efforts have been successful, but need to be expanded to include new colonies and to consider long-term persistence.
- Continue to monitor the population levels. This will be critical to understanding the causes of population fluctuations that could lead to extinction, potentially indicating a need for additional management. Carefully designed efforts may be used to measure the effects of land management practices and to determine population criteria for down- and delisting.
- Continue further searches for this species. Much effort has been spent attempting to survey these remote areas, and our success in 1995 indicates that everyone's efforts have paid off. The amount of potential habitat in the San Juan Mountains is extensive, and systematic prioritized survey efforts promise to uncover additional colonies.



## ACKNOWLEDGMENTS

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## INTRODUCTION

### Background

The Uncompahgre fritillary (*Boloria acrocnema*) is a glacial relict butterfly endemic to the San Juan Mountains of southwest Colorado. As of 1995, six colonies of this species are known, all confined to high elevation mesic alpine habitats. This species which believed to have been widely distributed near glacial margins during the Wisconsin glaciation but is now confined to small patches of habitat similar to those during glaciation. The loss of glacial habitats throughout the Rocky Mountains presumably led to the differentiation of this species from its sister taxon, *Boloria improba* (Gall 1984). Areas that currently support this species are effectively interglacial refugia where glacier-like environments have persisted through the Holocene to the present.

*Boloria acrocnema* was first discovered in 1978 (Gall and Sperling 1980), and since that time has been intensively studied by a number of researchers. Larry Gall (1984a) published research concerning the population structure, described the type locality habitat, and began to elucidate the ecology of the species. He also investigated the effects of capture and marking on this species (Gall 1984b). Britten and Brussard (1989) continued work to define the status of the species by updating population estimates, characterizing habitat requirements, investigating genetics, and searching for additional colonies. Britten (1991) expanded research in these areas, and Britten and Brussard (1992) present an analysis of biogeographic issues related to its divergence from its sister group. Britten et al. (1994) formally published a summary of work to that date on this species, emphasizing its immediate imperilment. Britten and Riley (1995) continued analysis of habitat requirements related to floral composition. Seidl (1995) presents the results of her four years of research that included population monitoring and the relation of environmental factors to population dynamics. A brief update of the population status of *Boloria acrocnema* is presented in Seidl and Opler (1995). Scott (1982, 1986), Ferris (1986), U.S. Forest Service et al. (1985) and (Gall 1983) also provide valuable insights to this species' biology and conservation.

Concern for the species' continued survival led to its listing as a candidate for federal endangered species status under the U.S. Endangered Species Act in 1982 (Federal Register, Vol. 49, p. 2167). Further research was conducted and on June 24, 1991 the species was listed as endangered (Federal Register, Vol. 56, pp. 28712-28718). Indeed the dramatic decline in population size seen in the late-1980's and the finding that the species is genetically depauperate (Brussard and Britten 1989) strongly suggest that this a



critically imperiled species. The apparent recovery in the early 1990's coincides with the species' listing, but the cause of population fluctuations remains unknown.

Potential factors that may have contributed to past declines include intensive collecting pressure, intensive grazing or trampling by domestic sheep, and periods of prolonged drought conditions (Brussard and Britten 1989). Other potential threats are minimized by the rugged and remote nature of the habitat and the inclusion of much of this area in established wilderness areas. However, the highly mineralized San Juan Mountains are heavily mined and future mining activities may impact this species and its habitat. The dramatic increase in recreational use at some *B. acrocnema* sites also threatens to reduce or degrade occupied habitat. Other sites are more remote and seldom visited.

Habitat for the species is loosely defined as mesic alpine areas, higher than 12,000 ft. (3658m), where its requisite host plant *Salix nivalis* (snow willow) grows. Such habitats typically occur on slopes with north to east aspects, though some north-northwest sites may also be suitable. These leeward and sun-sheltered aspects tend to accumulate and retain more of the winter snow pack and are often provided moisture by late-season snow melt. Attempts to narrowly define the habitat requirements of this species have been largely unsuccessful, but a slight affinity for sites with certain floral compositions (high diversity and the presence of *Trifolium*, or clover, species) has been demonstrated (Britten and Riley 1994).

## Objectives

The objectives of this project were twofold. First, it was our intent to continue population monitoring efforts established by previous researchers (Brussard and Britten 1989, Britten 1991, Seidl 1995). It was expected that the three known colonies (UP1, UP6, and RC1) would be monitored and that any other colonies would be counted as often as possible. Dedicated volunteers allowed us to also monitor the newly reconfirmed Alpine Gulch colony (AG2) as well.

Our second objective was to attempt to locate additional colonies at sites suspected to support colonies as well as additional likely areas. In the process, potential habitat was to be mapped within the inventory areas. Size estimates of the new colonies would be made as resources allowed.

## Study areas

Population monitoring continued at the three colonies known to exist prior to this summer (UP1 and UP6 near Uncompahgre Peak and RC1 near Redcloud Peak). In addition, we were able to obtain several weeks of data from the newly reconfirmed colony in Alpine Gulch (AG2). These areas are typical of the San Juan Mountains in being characterized by steep mountains of volcanic origin. The summits reach over 4200m (14,000ft.), 700m (3,000ft.) higher than treeline. The result is vast expanses of alpine habitat, large parts of which would appear to provide suitable *B. acrocnema* habitat.



This inventory targeted other ranges within the San Juan Mountains in addition to the extensively searched areas near the known colonies. The La Garita Mountains, forming the eastern extension of the San Juan Mountains, received most of the search effort in 1995. Other areas that were searched to some extent were the San Miguel Mountains in the west, and Bent and Carson Peaks on the Continental Divide southwest of Lake City. Still other areas were investigated remotely by inspecting topographic maps and aerial photography including the Pole Creek Mountain vicinity that lies in the headwaters of the Rio Grande River and Mount Ouray in the southern Sawatch Mountains. These areas all contain large areas of high alpine habitat that could potentially support *B. acrocnema*.

## MONITORING

### Methods

Methods for determining the annual size of Uncompahgre fritillary populations followed those of previous researchers as much as possible (Brussard and Britten 1989, Seidl 1995).

### *Transects.*

Both Seidl (1995) and Brussard and Britten (1989) describe a transect method based on a butterfly monitoring scheme widely employed in Great Britain and elsewhere (Pollard 1977, Thomas 1983). While Pollard's method has been modified in studies of *B. acrocnema*, it essentially entails walking over a set route while recording all of the butterflies observed within a given distance of the transect. Transects are placed in areas of high butterfly concentration.

Since the precise space occupied by a colony changes over even a few years, transects are established each year within areas of butterfly concentration. The length of these transects varied from 75m to 100m, and the number of transects used varied by site and by year (or researcher). Transects were set as soon as possible (Brussard and Britten 1989), or after 3-5 days of first emergence (A. Seidl pers. comm.). No mention was made of the density of transects (or the distance between transects).

A meeting of the Uncompahgre Fritillary Recovery Team in January 1995 indicated that a standard needed to be set to maintain consistency between years and researchers. A standard minimum of 30m between transects was determined after further consultation with Dr. P. Opler, Dr. H. Britten and A. Seidl. Previous studies had not used such a parameter and areas of butterfly concentration were the only factor in the placement of transects. However, previous transects, with few exceptions, met this standard (H. Britten, A. Seidl pers. comm.)

Our experience in 1995 resulted in employing the 30m-rule regularly since some areas of concentration were quite large and probably not fully represented by a single transect. The largest of these areas was at UP1 where a continuous area of concentration was 90m wide and over 120m long (three parallel transects were employed). While areas of concentration were evident, they were not synchronous within any one colony. Therefore, it was necessary to add transects as the flight season progressed. In 1995, there was as much as four weeks between emergence in areas within the same colony. To only use transects established within the first days of the flight would have ignored a large proportion of the butterflies present in this year. It was often the case that a discernible area of concentration would develop, but too near an established transect to add another transect. New transects were established if a significant number (>5 on a transect) of butterflies occurred at distances of 30m or greater from the existing transect.



As in previous transect counts, all adult Uncompahgre fritillary butterflies within 5m of the transect were counted as the observer walked at a steady pace of about 8-10min/100m. Counts were conducted on as many days as practical over the flight season given weather, logistics, and the endurance of field crews. Counts were only conducted under favorable flight conditions of full sun and minimal winds. The observer also used discretion in not counting on days or at times of pronounced low activity such as during times of full sun but cold temperatures. Counts were generally conducted between 9:00 and 9:30 am, but were started in places as late as 2:00 p.m. when weather did not allow earlier counts. Also, later sunrises in August often did not warm the colony sites by 9:30, forcing a slightly later start.

In summary, this method is as follows:

- Visit site often (every 2-3 days) beginning before anticipated date of emergence, and search area thoroughly for butterflies. Noting which other species are present, plant phenology and flowering, and the extent of snowpack are helpful in anticipating where and when first emergence will occur. The earliest dates recorded are near June 23, but *B. acrocneuma* did not emerge until August at one site in 1995.
- The colony sites should be searched thoroughly on each visit, even after transects have been set. Slowly walk the entire area that is free of snow, concentrating on areas with appropriately advanced plant phenology.
- Record extent of snow pack by shooting photographs from designated points in late June.
- When first adult *B. acrocneuma* are observed, mark points of observation with removable wire flags. If there are many observations, mark the extent of the concentration area. If there are already a concentration of butterflies present (more than five observations not separated by more than 30m) transects may be set up. If not, return to the areas on the following day and continue to mark observations until the concentration area can be defined. Remove these flags once the transect has been set.
- Transects are placed in all areas of butterfly concentration. Use as many transects as possible without placing transects within 30m of any existing transect. Their lengths should be such that they each cover an area of concentration. A transect may not be straight if the terrain and local distribution of butterflies so dictate, but changes in direction of the transect should always be obtuse. Mark the transects with removable flags. Place flags at either end and at any changes in direction. It is helpful for some observers to mark the 5m interval on either side of the transect

at its beginning. Precisely record the length and placement of all transects on a topographic map and in more detailed sketches of the site.

- Walk transects as often as possible through the flight season. Minimum suitable weather conditions of direct sun and minimal wind are required. Such conditions generally occur between 0900 and 1300h. The observer needs to use discretion in determining favorable conditions. Always record weather conditions (percent cloud cover, wind, temperature) and time for each count.
- Count all *B. acrocneuma* adults seen within 5m of the transect while walking at a consistent pace of about 8-10min/100m. Also count the similar species *B. titania* and *Euphydryas anicia*. Other butterflies on the sites may be of interest and should be recorded when it is practical.
- Continue to search all adjacent areas that may contains adult butterflies as often as possible, and set new transects where needed.
- All existing transects must be counted in a given day for the sample to be complete.
- Ideally, one should continue counts until the end of the flight. This may not always be practical (as was the case in 1995 due to the late onset of the season), in which case counts should be continued as long as possible. The more counts that are completed, the more accurate the population estimates can be.

### *Calculations.*

#### CALCULATING DAILY POPULATION INDICES:

Brussard and Britten (1989) found that, at the Redcloud Peak colony, total daily transect counts accounted for approximately 1/10 of the daily population estimates from simultaneous capture-mark-recapture(CMR) techniques. This daily index ( $N_i$ ) is found by simply multiplying the daily total of all transects within a single colony ( $t_i$ ) by 10.

$$N_i = 10 \times t_i$$

Since there is some question whether the same proportion (1/10) will hold true at other sites, this number has been used to calculate a daily **population index**. If the proportion of the actual daily population counted on the transects varies between sites, then this transect method will not be able to accurately discern population sizes between sites. Similarly, if this proportion varies significantly between years or between alternate



transect placements on different years, then comparisons between years may be confounded as well.

#### CALCULATING TOTAL POPULATION INDEX:

Calculation of a relative index of the total number of adults which emerged in a given brood, or year, is based on the methods of Gall's (1984a) CMR studies. The total population size is found by multiplying the sum of the daily populations by the daily loss rate (1-r) (Gall 1984, Watt et al 1977, Cook et al. 1967). Gall (1984a) found the residency rate (r), the proportion of individuals in the population from day *i* that remain on day *i*+1, to be approximately 0.6, thus rendering a value for the daily loss rate (1 -r) of 0.4.

$$\begin{aligned}\text{Total population index} &= \sum N_i \times (1-r) \\ &= \sum N_i \times 0.4\end{aligned}$$

Note that the method used here to calculate a total population index requires a value for every day for which the estimate is being made (Watt et al 1977, Cook et al 1967, Sheppard 1951), in this case the whole flight season. Previous studies by Gall (1984a) and Britten and Brussard (1989) had obtained values for every day over which their population size estimates were made. Gall (1984a) compensated for the portion of the flight period which was not sampled, while Brussard and Britten (1989) assumed that the significant majority of the flight period had been sampled in their efforts and did not compensate for any portion of the flight that was not sampled. This study, and that of Seidl (1995) could not, however, obtain values for every day of the flight season. It is therefore necessary to intercalculate values for days within the flight season which were not sampled. Here we have followed Watt et al. (1977) and Cook et al. (1967), who recommend averaging the values of the preceding and following two days to intercalculate missing values. We also found it necessary to estimate values for days at the end of flight period for which we were not present. In these cases, a simple linear extension of the declining trends for each transect, based on a line that best fit points beyond the peak, was used to predict daily values and the end date of the flight period.

#### Results

The 1995 flight season was apparently an unusual one for *Boloria acrocneuma*. The extremely large snowpack this year resulted in the sites being totally covered in snow at the end of June, the time of earliest recorded emergence. The first *B. acrocneuma* did not emerge until July 16, and some colonies did not begin flying until August 1. Additionally, this flight season was extended in comparison to the duration of flight reported by some previous researchers (Gall 1982, 1984a, Brussard and Britten 1989) who reported flight periods of only two weeks. Seidl (1991, 1994), however, reported flight periods around 30 days in length. In 1995 the observed flight period exceeded 30 days, but are estimated to have exceeded 40 days at some colonies.

1995 was apparently a "banner year" for *Boloria acrocnema* in terms of population size and continued increase. Although there are many problems in interpreting long term trends with the available data, it is apparent that monitored populations have been increasing since reaching extreme lows in the late 1980's (Britten et al. 1994a, Seidl and Opler 1994, Britten et al. 1994b, Seidl 1995). This trend apparently continued in 1995 when the odd-year brood reached near record abundance at all sites. Such high abundance of *B. acrocnema* this year may have been one reason for our success in documenting additional colonies.



## UP1.

The UP1 colony was visited periodically beginning July 28, at which time snow covered most of the basin and entirely covered the colony. The colony site was revisited and thoroughly searched seven times under favorable flight conditions without observing *B. acrocneuma* (June 28, July 5, 8, 16, 22, 25, 28). The first observation of adults occurred on August 1 when we discovered high densities of adults on the lowest portion of UP1. The high numbers observed on this day and the presence of females at this time (copulation was observed) suggest that the first emergence on this site was missed in spite of careful searches only three days earlier. Flight within the upper part of UP1 did not begin until August 2.

The discovery of a large concentration area of *B. acrocneuma* below the area that previously supported the UP1 colony (A. Seidl pers. comm, Gall 1984, Britten and Brussard 1989) was surprising. This area is on the gently sloping bench along the trail, before it gains the ridge. This concentration area is some 120m lower and 400m southeast of the colony reported by Gall (1984), and around 60m lower and 200m southeast of the area reported by A. Seidl (pers. comm.). This area was separated from the upper colony in 1995 by approximately 300m of horizontal distance and 100m of elevation. The topography here is such that much of this intervening area has a southeast aspect, and thus is likely not suitable for this species. Given the mean dispersal distance of this species reported by Gall (1984) of 50-60m, it seems reasonable to assume that there is significant demographic separation between the upper and lower portions. Indeed, in 1995 the subpopulations in each of these portions appeared to fluctuate separately, with the lower portion flying slightly sooner than the upper portion. In fact, the flight on the lower portion had nearly ceased while new concentration areas were still emerging on the upper portion. The difference in plant phenology between the two areas was also pronounced.

In all, 9 transects were used at UP1, three on the lower portion and six on the upper. A summary of each transect is given below:

### "Lower" UP1:

UP1a -- Active August 1-20. Total length = 130m

UP1b -- Active August 1-20. Total length = 191m

UP1c -- Active August 1-20. Total length = 148m

Total length of all transects = 469m

### "Upper" UP1:

UP1d -- Active August 2-20. Total length = 50m

UP1e -- Active August 5-20. Total length = 60m

UP1f -- Active August 5-20. Total length = 56m

UP1g -- Active August 10-20. Total length = 80m

UP1h -- Active August 10-20. Total length = 50m

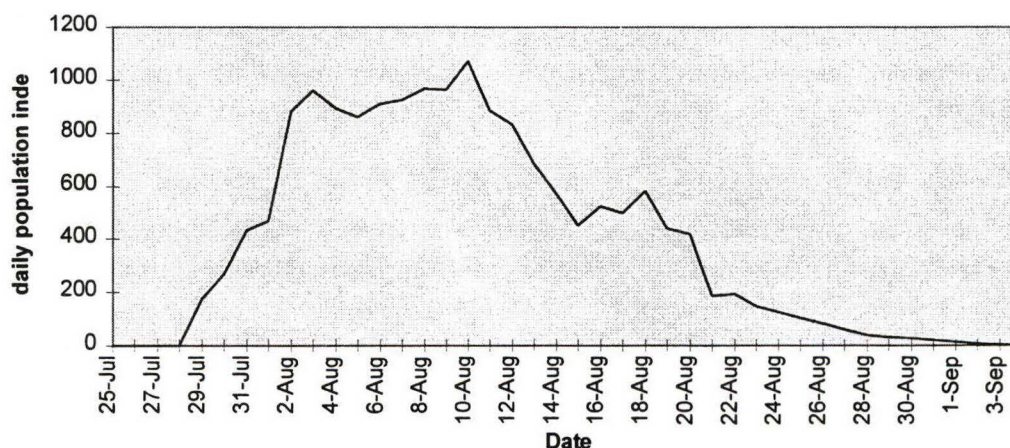
UP1i -- Active August 18-20. Total length = 50m

Total length of all transects = 346m

**Table 1** contains the results of counts on each of these transects. Daily totals have been computed for the whole UP1 as well as for the upper and lower portions independently. Intercalculated values are shown underlined.

**Figure 1** illustrates the change in daily population through the 1995 season on the entire UP1 colony.

**Figure 1. UP1 total.**





Figures 2 - 5 display each portion of the UP1 colony separately, giving both total daily population as well as the numbers observed on each transect as a part of the daily sum of numbers observed.

Figure 2. "Lower" UP1 total.

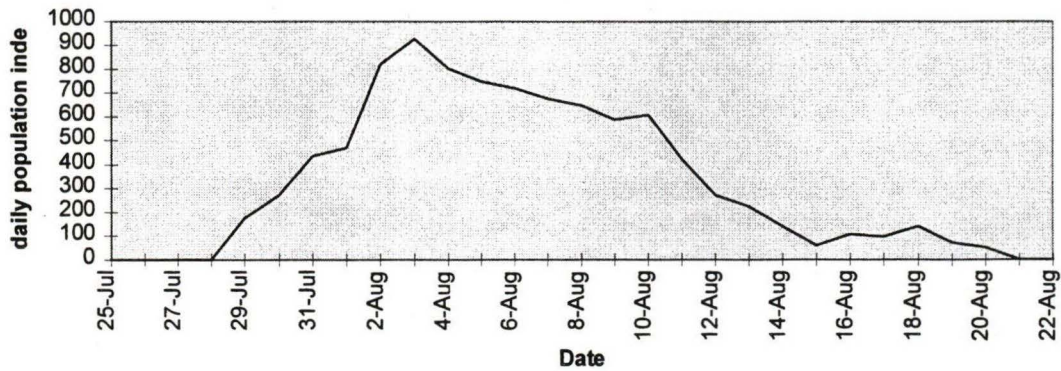


Figure 3. "Lower" UP1 all transects.

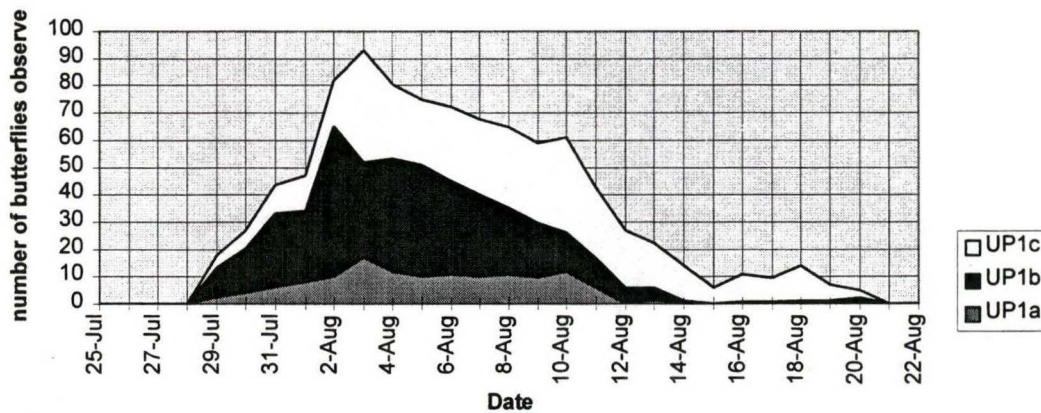


Figure 4. "Upper" UP1 total.

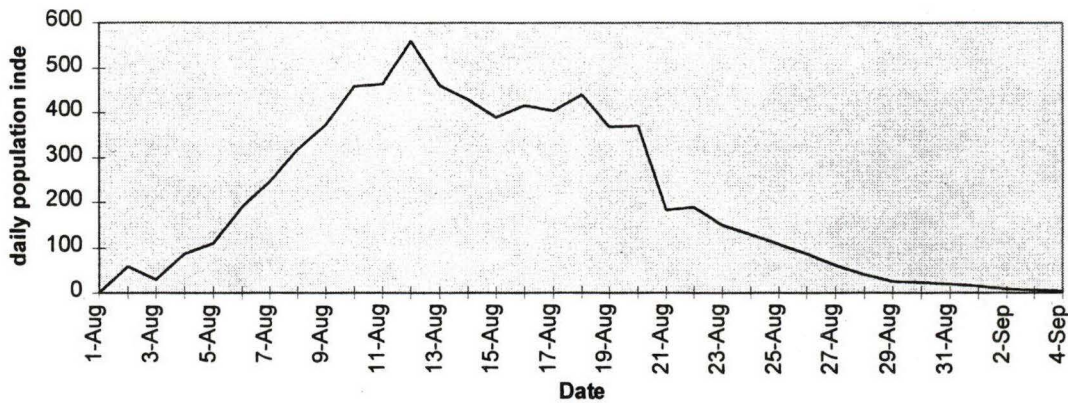
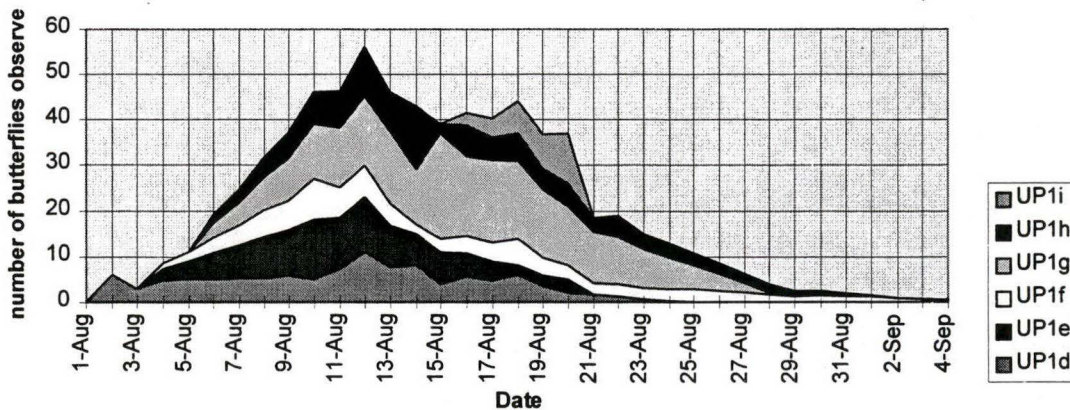


Figure 5. "Upper" UP1 all transects



The estimated total population index for UP1 in 1995 is 6682. Treated separately, the upper colony produces an index of 2888, and the lower 3794.

Within the lower portion, peak daily population occurred on August 3 with a daily population index of 930. This translates into a density on this date of approximately 20 adult *B. acrocnema* per 100m of transect. The flight here is estimated to have been contained between July 29 and August 21, a total of 24 days.

Within the upper portion, peak daily population occurred on August 12 with a daily population index of 560. Average density on this date reached only 13 adult *B. acrocnema* per 100m of transect. The flight period here began August 2 and the rate of decline suggests that the flight continued to September 4, a total of 34 days.



Table 1. UP1 1995 transect data.

| Date                   | "Lower" UP1 |      |      | TOTAL |                  | "Upper" UP1 |      |      |      |      |      | TOTAL |                  | Total UP1 |                           |
|------------------------|-------------|------|------|-------|------------------|-------------|------|------|------|------|------|-------|------------------|-----------|---------------------------|
|                        | UP1a        | UP1b | UP1c | count | daily pop. index | UP1d        | UP1e | UP1f | UP1g | UP1h | UP1i | count | daily pop. index | count     | TOTAL<br>daily pop. index |
| 25-Jul                 | 0           | 0    | 0    | 0     | 0                | 0           | 0    | 0    | 0    | 0    | 0    | 0     | 0                | 0         | 0                         |
| 26-Jul                 | 0           | 0    | 0    | 0     | 0                | 0           | 0    | 0    | 0    | 0    | 0    | 0     | 0                | 0         | 0                         |
| 27-Jul                 | 0           | 0    | 0    | 0     | 0                | 0           | 0    | 0    | 0    | 0    | 0    | 0     | 0                | 0         | 0                         |
| 28-Jul                 | 0           | 0    | 0    | 0     | 0                | 0           | 0    | 0    | 0    | 0    | 0    | 0     | 0                | 0         | 0                         |
| 29-Jul                 | 3           | 11   | 4    | 18    | 176              | 0           | 0    | 0    | 0    | 0    | 0    | 0     | 0                | 18        | 176                       |
| 30-Jul                 | 4           | 16   | 7    | 27    | 270              | 0           | 0    | 0    | 0    | 0    | 0    | 0     | 0                | 27        | 270                       |
| 31-Jul                 | 6           | 27   | 10   | 43    | 434              | 0           | 0    | 0    | 0    | 0    | 0    | 0     | 0                | 43        | 434                       |
| 1-Aug                  | 8           | 26   | 13   | 47    | 470              | 0           | 0    | 0    | 0    | 0    | 0    | 0     | 0                | 47        | 470                       |
| 2-Aug                  | 10          | 55   | 17   | 82    | 820              | 6           | 0    | 0    | 0    | 0    | 0    | 6     | 60               | 88        | 880                       |
| 3-Aug                  | 17          | 35   | 41   | 93    | 930              | 3           | 0    | 0    | 0    | 0    | 0    | 3     | 30               | 96        | 960                       |
| 4-Aug                  | 12          | 41   | 27   | 81    | 805              | 5           | 2    | 1    | 0    | 0    | 0    | 9     | 85               | 89        | 890                       |
| 5-Aug                  | 10          | 41   | 24   | 75    | 750              | 5           | 4    | 2    | 0    | 0    | 0    | 11    | 110              | 86        | 860                       |
| 6-Aug                  | 11          | 34   | 27   | 72    | 721              | 5           | 6    | 3    | 3    | 2    | 0    | 19    | 190              | 91        | 911                       |
| 7-Aug                  | 10          | 30   | 28   | 68    | 678              | 5           | 7    | 4    | 5    | 3    | 0    | 25    | 247              | 92        | 925                       |
| 8-Aug                  | 11          | 24   | 30   | 65    | 650              | 5           | 9    | 6    | 7    | 4    | 0    | 32    | 317              | 97        | 967                       |
| 9-Aug                  | 10          | 20   | 29   | 59    | 590              | 6           | 10   | 7    | 9    | 6    | 0    | 37    | 372              | 96        | 962                       |
| 10-Aug                 | 12          | 14   | 35   | 61    | 610              | 5           | 13   | 9    | 12   | 7    | 0    | 46    | 460              | 107       | 1070                      |
| 11-Aug                 | 6           | 11   | 25   | 42    | 423              | 7           | 11   | 7    | 13   | 8    | 0    | 46    | 463              | 89        | 887                       |
| 12-Aug                 | 0           | 6    | 21   | 27    | 270              | 11          | 12   | 7    | 15   | 11   | 0    | 56    | 560              | 83        | 830                       |
| 13-Aug                 | 1           | 5    | 16   | 22    | 223              | 8           | 9    | 5    | 16   | 9    | 0    | 46    | 461              | 68        | 684                       |
| 14-Aug                 | 0           | 1    | 13   | 14    | 140              | 8           | 7    | 2    | 12   | 14   | 0    | 43    | 430              | 57        | 570                       |
| 15-Aug                 | 0           | 0    | 6    | 6     | 60               | 4           | 7    | 3    | 23   | 2    | 0    | 39    | 390              | 45        | 450                       |
| 16-Aug                 | 0           | 1    | 10   | 11    | 109              | 6           | 5    | 4    | 18   | 7    | 3    | 42    | 416              | 52        | 525                       |
| 17-Aug                 | 0           | 1    | 9    | 10    | 95               | 5           | 4    | 4    | 18   | 5    | 4    | 40    | 404              | 50        | 499                       |
| 18-Aug                 | 0           | 1    | 13   | 14    | 140              | 6           | 2    | 6    | 17   | 6    | 7    | 44    | 440              | 58        | 580                       |
| 19-Aug                 | 0           | 1    | 6    | 7     | 71               | 4           | 2    | 4    | 15   | 5    | 7    | 37    | 369              | 44        | 440                       |
| 20-Aug                 | 0           | 2    | 3    | 5     | 50               | 2           | 3    | 3    | 13   | 5    | 11   | 37    | 370              | 42        | 420                       |
| 21-Aug                 | 0           | 0    | 0    | 0     | 0                | 2           | 0    | 3    | 11   | 3    |      | 19    | 187              | 19        | 187                       |
| 22-Aug                 | 0           | 0    | 0    | 0     | 0                | 2           | 0    | 3    | 10   | 5    |      | 19    | 194              | 19        | 194                       |
| 23-Aug                 | 0           | 0    | 0    | 0     | 0                | 0           | 0    | 3    | 8    | 3    |      | 15    | 147              | 15        | 147                       |
| 24-Aug                 | 0           | 0    | 0    | 0     | 0                | 0           | 0    | 3    | 7    | 3    |      | 12    | 125              | 12        | 125                       |
| 25-Aug                 | 0           | 0    | 0    | 0     | 0                | 0           | 0    | 2    | 5    | 3    |      | 10    | 102              | 10        | 102                       |
| 26-Aug                 | 0           | 0    | 0    | 0     | 0                | 0           | 0    | 2    | 4    | 2    |      | 8     | 83               | 8         | 83                        |
| 27-Aug                 | 0           | 0    | 0    | 0     | 0                | 0           | 0    | 2    | 2    | 2    |      | 6     | 62               | 6         | 62                        |
| 28-Aug                 | 0           | 0    | 0    | 0     | 0                | 0           | 0    | 2    | 0    | 2    |      | 4     | 41               | 4         | 41                        |
| 29-Aug                 | 0           | 0    | 0    | 0     | 0                | 0           | 0    | 2    | 0    | 1    |      | 3     | 31               | 3         | 31                        |
| 30-Aug                 | 0           | 0    | 0    | 0     | 0                | 0           | 0    | 2    | 0    | 1    |      | 3     | 28               | 3         | 28                        |
| 31-Aug                 | 0           | 0    | 0    | 0     | 0                | 0           | 0    | 1    | 0    | 1    |      | 2     | 20               | 2         | 20                        |
| 1-Sep                  | 0           | 0    | 0    | 0     | 0                | 0           | 0    | 1    | 0    | 0    |      | 1     | 14               | 1         | 14                        |
| 2-Sep                  | 0           | 0    | 0    | 0     | 0                | 0           | 0    | 1    | 0    | 0    |      | 1     | 7                | 1         | 7                         |
| 3-Sep                  | 0           | 0    | 0    | 0     | 0                | 0           | 0    | 0    | 0    | 0    |      | 0     | 5                | 0         | 5                         |
| 4-Sep                  | 0           | 0    | 0    | 0     | 0                | 0           | 0    | 0    | 0    | 0    |      | 0     | 0                | 0         | 0                         |
| SUM DAILY COUNTS       |             |      |      |       | 9485             |             |      |      |      |      |      |       | 7220             |           | 16705                     |
| TOTAL POPULATION INDEX |             |      |      |       | 3794             |             |      |      |      |      |      |       | 2888             |           | 6682                      |

Underlined values have been extrapolated. All values are rounded to the nearest integer after performing calculations.

## UP6.

The UP6 colony was visited periodically beginning June 28, at which time the colony was entirely buried by snow. The colony was visited and thoroughly searched on seven days (June 28, July 2, 5, 8, 13, 16, and 20) before the first observation of *B. acrocneuma* was made on July 22.

A total of only two transects were used here in 1995. A summary of each is given below:

UP6a -- Active July 24 - August 18. Total length = 166m.

UP6b -- Active July 26 - August 18. Total length = 63m

Total length of all transects = 229m.

A few observations of *B. acrocneuma* were made in an area approximately 40m southeast of UP6a, but observations were too few to establish an additional transect. Repeated searches in this area did not result in additional sightings.

**Table 2** contains the results of counts on these transects. Daily totals for the colony are displayed, and intercalculated values are shown underlined.

**Figures 6 and 7** display the total daily population index and the total numbers observed each day, with the relative contribution of each transect to the daily sum shown.

Figure 6. UP6 total.

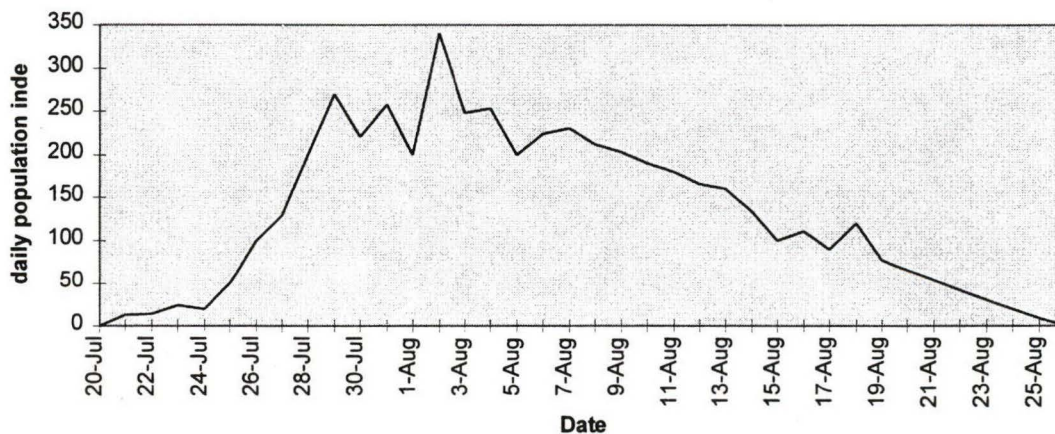
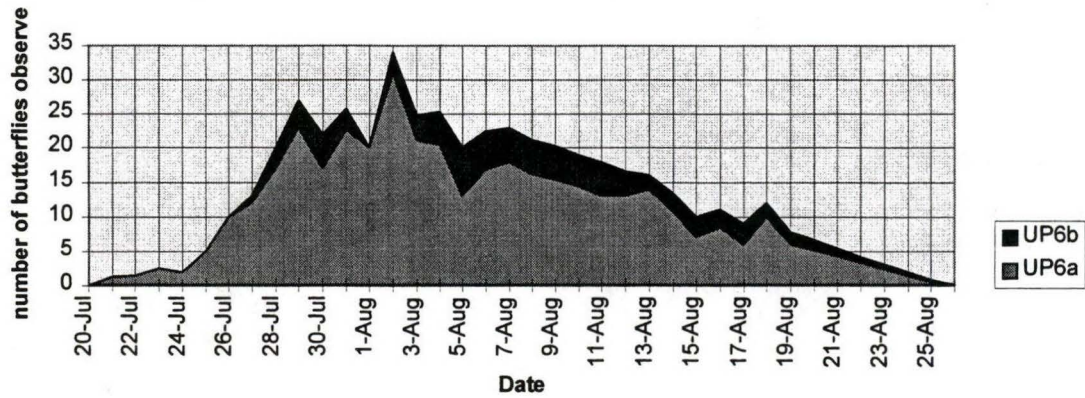




Figure 7. UP6 all transects.



The total population index for UP6 in 1995 is 1979. Peak daily population occurred on August 2 with an index value of 340. Average density on this date reached 15 adult *B. acrocne* per 100m of transect.

Table 2. UP6 colony 1995 transect data.

| Date                   | UP6a      | UP6b     | TOTAL |                  |
|------------------------|-----------|----------|-------|------------------|
|                        |           |          | count | daily pop. index |
| 20-Jul                 | 0         | 0        | 0     | 0                |
| 21-Jul                 | <u>1</u>  | <u>0</u> | 1     | 13               |
| 22-Jul                 | <u>1</u>  | <u>0</u> | 1     | 14               |
| 23-Jul                 | <u>2</u>  | <u>0</u> | 2     | 24               |
| 24-Jul                 | 2         | 0        | 2     | 20               |
| 25-Jul                 | 5         | 0        | 5     | 50               |
| 26-Jul                 | 10        | 0        | 10    | 100              |
| 27-Jul                 | 12        | 1        | 13    | 130              |
| 28-Jul                 | 17        | 3        | 20    | 200              |
| 29-Jul                 | 23        | 4        | 27    | 270              |
| 30-Jul                 | 17        | 5        | 22    | 220              |
| 31-Jul                 | <u>23</u> | <u>3</u> | 26    | 258              |
| 1-Aug                  | 20        | 0        | 20    | 200              |
| 2-Aug                  | 31        | 3        | 34    | 340              |
| 3-Aug                  | <u>21</u> | <u>4</u> | 25    | 248              |
| 4-Aug                  | <u>21</u> | <u>5</u> | 25    | 253              |
| 5-Aug                  | 13        | 7        | 20    | 200              |
| 6-Aug                  | <u>17</u> | <u>5</u> | 22    | 224              |
| 7-Aug                  | 18        | 5        | 23    | 230              |
| 8-Aug                  | <u>16</u> | <u>5</u> | 21    | 212              |
| 9-Aug                  | <u>15</u> | <u>5</u> | 20    | 203              |
| 10-Aug                 | <u>14</u> | <u>5</u> | 19    | 190              |
| 11-Aug                 | 13        | 5        | 18    | 180              |
| 12-Aug                 | <u>13</u> | <u>4</u> | 17    | 166              |
| 13-Aug                 | 14        | 2        | 16    | 160              |
| 14-Aug                 | <u>11</u> | <u>3</u> | 13    | 134              |
| 15-Aug                 | 7         | 3        | 10    | 100              |
| 16-Aug                 | <u>8</u>  | <u>3</u> | 11    | 111              |
| 17-Aug                 | 6         | 3        | 9     | 90               |
| 18-Aug                 | 10        | 2        | 12    | 120              |
| 19-Aug                 | <u>6</u>  | <u>2</u> | 8     | 78               |
| 20-Aug                 | <u>5</u>  | <u>1</u> | 7     | 66               |
| 21-Aug                 | <u>4</u>  | <u>1</u> | 5     | 54               |
| 22-Aug                 | <u>3</u>  | <u>1</u> | 4     | 42               |
| 23-Aug                 | <u>2</u>  | <u>1</u> | 3     | 30               |
| 24-Aug                 | <u>1</u>  | <u>1</u> | 2     | 19               |
| 25-Aug                 | <u>1</u>  | <u>0</u> | 1     | 9                |
| 26-Aug                 | <u>0</u>  | <u>0</u> | 0     | 0                |
| SUM DAILY COUNTS       |           |          | 4949  |                  |
| TOTAL POPULATION INDEX |           |          | 1979  |                  |

Underlined values have been extrapolated.  
All values are rounded to the nearest integer after performing calculations.



## RC1.

The RC1 colony was visited repeatedly beginning June 27, at which time the colony was nearly entirely covered with snow. The colony was visited and thoroughly searched on six days (June 27, July 1, 6, 11, 12, and 13) before the first observation of *B. acrocnema* was made on July 16.

A total of 11 transects were used in 1995. A summary of each is given below:

RC1a -- Active July 21 - August 18. Total length = 60m.

RC1b -- Active July 21 - August 18. Total length = 85m.

RC1c -- Active July 21 - August 18. Total length = 74m.

RC1d -- Active July 21 - August 18. Total length = 67m.

RC1e -- Active July 22 - August 18. Total length = 70m.

RC1f -- Active July 22 - August 18. Total length = 50m.

RC1g -- Active July 26 - August 18. Total length = 70m.

RC1h -- Active July 26 - August 18. Total length = 97m.

RC1i -- Active July 27 - August 18. Total length = 52m.

RC1j -- Active July 28 - August 18. Total length = 53m.

RC1k -- Active August 4 - 18. Total length = 75m.

**Table 3** contains the results of counts on these transects. Daily totals for the colony are displayed, and intercalculated values are underlined.

**Figure 8** shows the daily population index throughout the 1995 flight.

Figure 8. RC1 total.

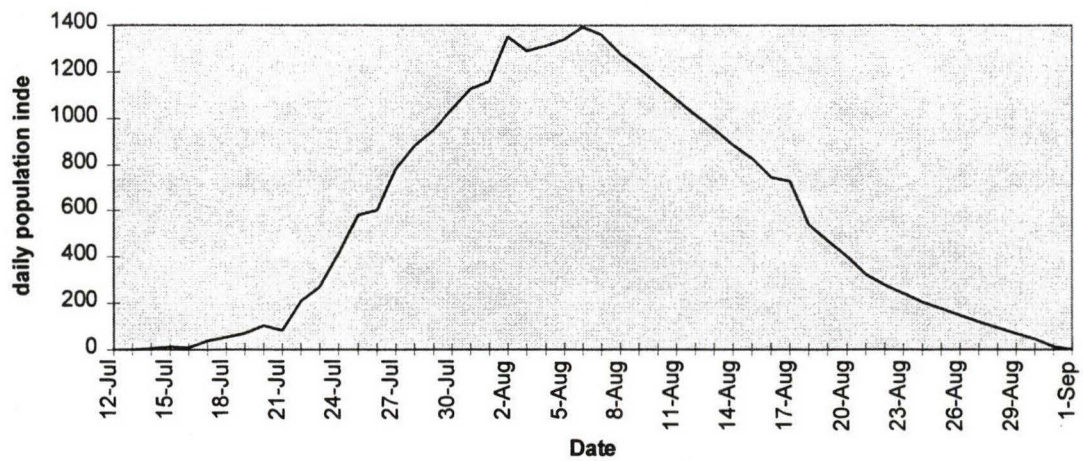
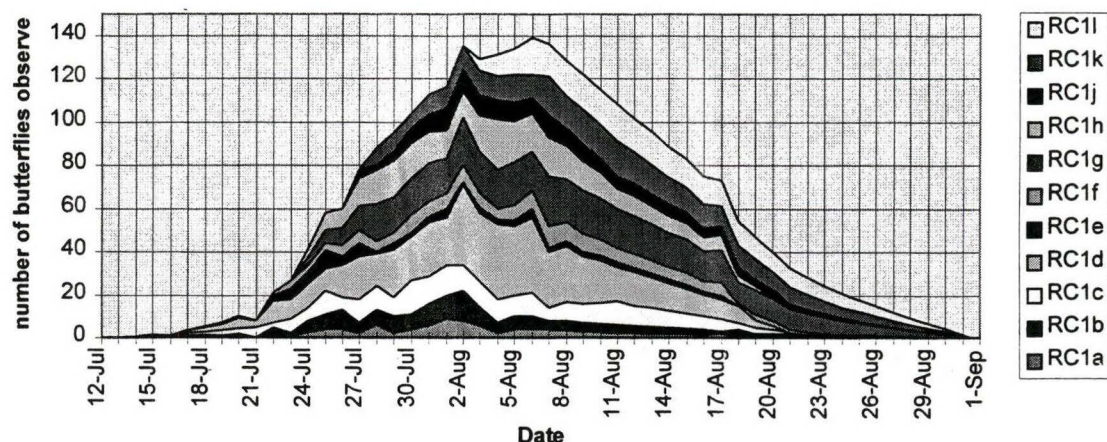




Figure 9 displays the summed results for the whole colony, with the relative contribution of each transect to the daily sum of numbers observed displayed.

Table 9. RC1 all transects



The total population index for RC1 in 1995 is 11,773. Peak daily population occurred on August 6 with an index value of 1390. Average density on this date was 18 adult *B. acrocne* per 100m of transect.

The observed flight period extended from July 16 to August 18, but extrapolating from the declining trend between August 6 and 18 results in an estimated end of flight season at August 31. This gives an estimated flight duration of 46 days, almost 50% greater than the longest previously recorded flight for this species (Seidl 1995).

Table 3. RC1 colony 1995 transect data.

| Date                   | RC1a | RC1b | RC1c | RC1d | RC1e | RC1f | RC1g | RC1h | RC1j | RC1k | RC1l | TOTAL |             |
|------------------------|------|------|------|------|------|------|------|------|------|------|------|-------|-------------|
|                        |      |      |      |      |      |      |      |      |      |      |      | count | daily index |
| 12-Jul                 | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0     | 0           |
| 13-Jul                 | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0     | 0           |
| 14-Jul                 | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1     | 6           |
| 15-Jul                 | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1     | 13          |
| 16-Jul                 | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1     | 10          |
| 17-Jul                 | 1    | 0    | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 4     | 37          |
| 18-Jul                 | 1    | 1    | 2    | 2    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 5     | 55          |
| 19-Jul                 | 0    | 1    | 3    | 3    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 7     | 69          |
| 20-Jul                 | 1    | 1    | 3    | 4    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 10    | 103         |
| 21-Jul                 | 0    | 0    | 5    | 3    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 8     | 80          |
| 22-Jul                 | 1    | 4    | 2    | 10   | 3    | 1    | 0    | 0    | 0    | 0    | 0    | 21    | 210         |
| 23-Jul                 | 1    | 1    | 7    | 9    | 5    | 4    | 0    | 0    | 0    | 0    | 0    | 27    | 270         |
| 24-Jul                 | 3    | 5    | 7    | 11   | 5    | 3    | 4    | 4    | 0    | 0    | 0    | 42    | 415         |
| 25-Jul                 | 4    | 7    | 11   | 10   | 9    | 3    | 6    | 8    | 0    | 0    | 0    | 58    | 580         |
| 26-Jul                 | 4    | 9    | 6    | 15   | 4    | 5    | 8    | 9    | 0    | 0    | 0    | 60    | 600         |
| 27-Jul                 | 2    | 5    | 11   | 20   | 6    | 6    | 11   | 13   | 4    | 0    | 0    | 78    | 780         |
| 28-Jul                 | 6    | 7    | 11   | 15   | 1    | 5    | 17   | 16   | 2    | 8    | 0    | 88    | 880         |
| 29-Jul                 | 2    | 8    | 9    | 22   | 3    | 5    | 16   | 17   | 4    | 9    | 0    | 95    | 950         |
| 30-Jul                 | 4    | 7    | 16   | 20   | 2    | 8    | 17   | 16   | 7    | 7    | 0    | 104   | 1040        |
| 31-Jul                 | 6    | 10   | 13   | 25   | 3    | 7    | 18   | 15   | 8    | 9    | 0    | 113   | 1125        |
| 1-Aug                  | 9    | 11   | 14   | 22   | 4    | 7    | 16   | 13   | 10   | 10   | 0    | 116   | 1160        |
| 2-Aug                  | 8    | 14   | 12   | 37   | 1    | 8    | 22   | 12   | 10   | 11   | 0    | 135   | 1350        |
| 3-Aug                  | 6    | 9    | 12   | 31   | 2    | 7    | 19   | 17   | 9    | 11   | 5    | 129   | 1289        |
| 4-Aug                  | 2    | 5    | 11   | 35   | 2    | 5    | 18   | 23   | 9    | 11   | 10   | 131   | 1310        |
| 5-Aug                  | 4    | 6    | 10   | 32   | 3    | 7    | 19   | 19   | 9    | 13   | 12   | 134   | 1337        |
| 6-Aug                  | 4    | 6    | 11   | 35   | 4    | 8    | 18   | 18   | 7    | 11   | 17   | 139   | 1390        |
| 7-Aug                  | 4    | 4    | 6    | 26   | 2    | 10   | 23   | 18   | 10   | 18   | 15   | 136   | 1360        |
| 8-Aug                  | 3    | 5    | 9    | 26   | 3    | 8    | 20   | 15   | 8    | 15   | 16   | 128   | 1279        |
| 9-Aug                  | 3    | 4    | 9    | 22   | 2    | 8    | 20   | 14   | 8    | 16   | 16   | 122   | 1217        |
| 10-Aug                 | 3    | 4    | 9    | 20   | 2    | 8    | 19   | 12   | 7    | 15   | 16   | 115   | 1148        |
| 11-Aug                 | 2    | 4    | 11   | 16   | 2    | 7    | 18   | 9    | 6    | 16   | 17   | 108   | 1080        |
| 12-Aug                 | 2    | 4    | 9    | 16   | 2    | 7    | 17   | 9    | 6    | 14   | 16   | 102   | 1017        |
| 13-Aug                 | 2    | 3    | 9    | 14   | 2    | 6    | 17   | 8    | 5    | 14   | 15   | 95    | 953         |
| 14-Aug                 | 2    | 3    | 8    | 13   | 2    | 6    | 16   | 8    | 5    | 13   | 14   | 89    | 886         |
| 15-Aug                 | 2    | 2    | 7    | 12   | 2    | 6    | 15   | 7    | 5    | 11   | 13   | 83    | 829         |
| 16-Aug                 | 1    | 3    | 6    | 10   | 1    | 5    | 14   | 6    | 4    | 11   | 13   | 75    | 746         |
| 17-Aug                 | 2    | 1    | 6    | 9    | 2    | 6    | 15   | 7    | 4    | 9    | 12   | 73    | 730         |
| 18-Aug                 | 0    | 4    | 3    | 8    | 0    | 1    | 10   | 3    | 4    | 10   | 11   | 54    | 540         |
| 19-Aug                 | 0    | 2    | 3    | 3    | 0    | 3    | 11   | 2    | 3    | 10   | 10   | 47    | 472         |
| 20-Aug                 | 0    | 2    | 2    | 2    | 0    | 2    | 11   | 1    | 3    | 8    | 10   | 40    | 401         |
| 21-Aug                 | 0    | 2    | 1    | 0    | 0    | 2    | 10   | 0    | 2    | 8    | 9    | 32    | 325         |
| 22-Aug                 | 0    | 1    | 0    | 0    | 0    | 1    | 9    | 0    | 2    | 7    | 8    | 28    | 280         |
| 23-Aug                 | 0    | 1    | 0    | 0    | 0    | 1    | 8    | 0    | 2    | 6    | 7    | 24    | 243         |
| 24-Aug                 | 0    | 1    | 0    | 0    | 0    | 0    | 7    | 0    | 1    | 5    | 6    | 21    | 205         |
| 25-Aug                 | 0    | 1    | 0    | 0    | 0    | 0    | 6    | 0    | 1    | 5    | 5    | 18    | 177         |
| 26-Aug                 | 0    | 1    | 0    | 0    | 0    | 0    | 5    | 0    | 0    | 4    | 5    | 15    | 148         |
| 27-Aug                 | 0    | 1    | 0    | 0    | 0    | 0    | 4    | 0    | 0    | 3    | 4    | 12    | 119         |
| 28-Aug                 | 0    | 0    | 0    | 0    | 0    | 0    | 3    | 0    | 0    | 3    | 3    | 9     | 94          |
| 29-Aug                 | 0    | 0    | 0    | 0    | 0    | 0    | 2    | 0    | 0    | 2    | 2    | 7     | 68          |
| 30-Aug                 | 0    | 0    | 0    | 0    | 0    | 0    | 2    | 0    | 0    | 1    | 2    | 5     | 45          |
| 31-Aug                 | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 0    | 0    | 0    | 1    | 1     | 12          |
| 1-Sep                  | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0     | 0           |
| SUM DAILY COUNTS       |      |      |      |      |      |      |      |      |      |      |      | 29433 |             |
| TOTAL POPULATION INDEX |      |      |      |      |      |      |      |      |      |      |      | 11773 |             |

Underlined values have been extrapolated.

All values are rounded to the nearest integer after performing calculations.

## AG2.

The existence of a colony at AG2 had been previously suspected. Brussard and Britten (1989) found a very small number of butterflies at this site in 1988, but surveys for an odd-year brood in 1987 found no *B. acrocneuma* present. Later searches also could not locate any *B. acrocneuma* (Seidl 1994). Revisits in 1995, however, revealed a relatively small colony existing in nearly the precise locality that they were observed in 1988.

The site of this colony was first visited in 1995 on July 24. *B. acrocneuma* was immediately observed in almost the precise location of previous observations (Brussard and Britten 1989). Casual search of the area resulted in 20-30 observations.. The first emergence at this colony was evidently missed, occurring some time prior to July 24. A transect was set and initiated as soon as possible on July 28.

Two transects were employed at this colony. Each is summarized below:

AG2a -- Active July 28 - August 18. Total length = 76m.

AG2b -- Active August 2 - 18. Total length = 66m

**Table 4** contains the results of counts on these transects. Daily totals for the colony are displayed, and intercalculated values are shown underlined.

**Figure 10** displays the daily population through the flight period.

**Figure 10. AG2 total.**

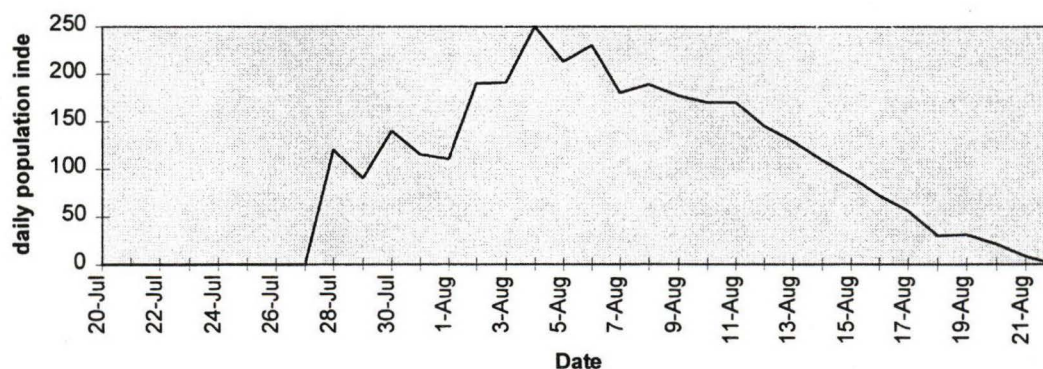
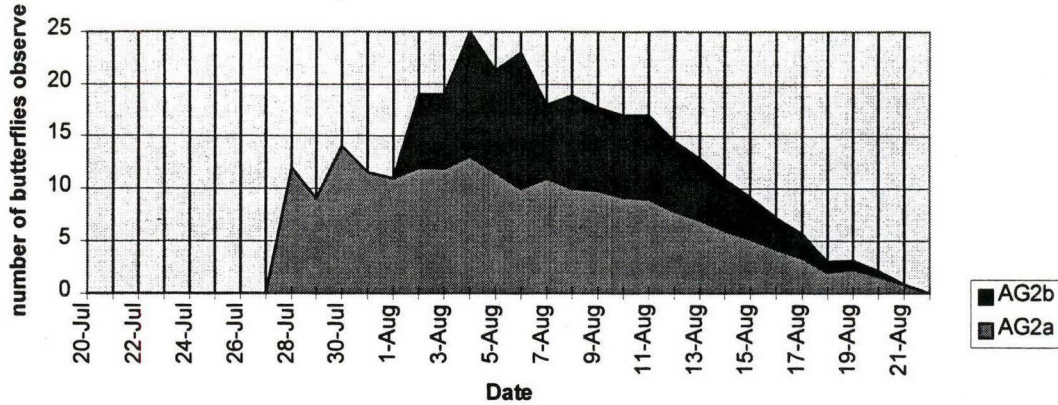


**Figure 11** display results for each transect separately as a part of the summed total daily observations.



Figure 11. AG2 all transects.



The total population index for AG2 in 1995 is 1291, but would be higher if we accounted for the early portion of the flight that must have been missed. Peak daily population occurred on August 4 with an index value of 250. Density at peak population averaged 18 adult *B. acrocnema* per 100m of transect.

Flight at this colony was observed from June 24 to August 18, but linear trends extended from the beginning and end of the flight period give an estimated flight season extending from July 21 to August 21, a period of 31 days.

Table 4. AG2 colony 1995 transect data.

| Date                   | AG2a      | AG2b      | count | TOTAL<br>daily pop.index |
|------------------------|-----------|-----------|-------|--------------------------|
| 20-Jul                 | <u>0</u>  | <u>0</u>  | 0     | 0                        |
| 21-Jul                 | <u>0</u>  | <u>0</u>  | 0     | 0                        |
| 22-Jul                 | <u>0</u>  | <u>0</u>  | 0     | 0                        |
| 23-Jul                 | <u>0</u>  | <u>0</u>  | 0     | 0                        |
| 24-Jul                 | <u>0</u>  | <u>0</u>  | 0     | 0                        |
| 25-Jul                 | <u>0</u>  | <u>0</u>  | 0     | 0                        |
| 26-Jul                 | <u>0</u>  | <u>0</u>  | 0     | 0                        |
| 27-Jul                 | <u>0</u>  | <u>0</u>  | 0     | 0                        |
| 28-Jul                 | 12        | 0         | 12    | 120                      |
| 29-Jul                 | 9         | 0         | 9     | 90                       |
| 30-Jul                 | 14        | 0         | 14    | 140                      |
| 31-Jul                 | <u>12</u> | <u>0</u>  | 12    | 115                      |
| 1-Aug                  | 11        | 0         | 11    | 110                      |
| 2-Aug                  | 12        | 7         | 19    | 190                      |
| 3-Aug                  | <u>12</u> | <u>7</u>  | 19    | 191                      |
| 4-Aug                  | 13        | 12        | 25    | 250                      |
| 5-Aug                  | <u>11</u> | <u>10</u> | 21    | 213                      |
| 6-Aug                  | 10        | 13        | 23    | 230                      |
| 7-Aug                  | 11        | 7         | 18    | 180                      |
| 8-Aug                  | <u>10</u> | <u>9</u>  | 19    | 189                      |
| 9-Aug                  | <u>10</u> | <u>8</u>  | 18    | 177                      |
| 10-Aug                 | <u>9</u>  | <u>8</u>  | 17    | 170                      |
| 11-Aug                 | 9         | 8         | 17    | 170                      |
| 12-Aug                 | <u>8</u>  | <u>7</u>  | 14    | 145                      |
| 13-Aug                 | <u>7</u>  | <u>6</u>  | 13    | 129                      |
| 14-Aug                 | <u>6</u>  | <u>5</u>  | 11    | 109                      |
| 15-Aug                 | <u>5</u>  | <u>4</u>  | 9     | 91                       |
| 16-Aug                 | <u>4</u>  | <u>3</u>  | 7     | 72                       |
| 17-Aug                 | <u>3</u>  | <u>2</u>  | 6     | 56                       |
| 18-Aug                 | 2         | 1         | 3     | 30                       |
| 19-Aug                 | <u>2</u>  | <u>1</u>  | 3     | 31                       |
| 20-Aug                 | <u>2</u>  | <u>0</u>  | 2     | 21                       |
| 21-Aug                 | <u>1</u>  | <u>0</u>  | 1     | 8                        |
| 22-Aug                 | <u>0</u>  | <u>0</u>  | 0     | 0                        |
| SUM DAILY COUNTS       |           |           |       | 3227                     |
| TOTAL POPULATION INDEX |           |           |       | 1291                     |

Underlined values have been extrapolated.

All values are rounded to the nearest integer after performing calculations.

### ***Baldy Chato.***

The existence of a colony at the Baldy Chato site had been previously suspected. Brussard and Britten (1989) found a single *B. acrocneuma* female here in 1988. In 1994, the site was again visited and one or two *B. acrocneuma* were observed (Ireland 1994). Visits in 1995 revealed a relatively small colony existing in nearly the precise locality that they were observed previously.

The site of this colony was first visited in 1995 on June 29, at which time the site was mostly covered in snow. Revisits were made prior to the detection of the flight here on July 7, 17, 21, and 22. On July 31 *B. acrocneuma* was observed in almost the precise location of previous observations, and the flight was obviously in progress. The first emergence at this colony was evidently missed, occurring some time between July 22 - 31. Two transects were set and initiated as soon as possible on August 2. Only two daily counts could be made, and protocol was not strictly adhered to. Nonetheless, counts on August 2 and 5 reported 93 and 65 *B. acrocneuma* respectively. A thorough search of the site over many hours (not a transect count) on August 3 resulted in 104 observations. If the phenology of this colony was approximately synchronous with the other colonies, then these counts took place near the peak flight. While a meaningful population estimate is not possible, it appears that the peak daily population exceeded 100 or more individuals. An intuitive estimate based on observations by searchers placed peak daily population even higher.

### ***Baldy Cinco.***

The existence of a colony at the Baldy Cinco site had not been suspected prior to this survey. Aerial photograph inspection had located this area as one of the most promising in this part of the range and was a high priority for survey. The site was first visited on July 25 and *B. acrocneuma* was found to be present in a small part of the survey area. The site was revisited for verification on July 28 and a flight was found to be in progress. Transects were established on that day and three daily counts were made. The scarcity of data again do not allow for an accurate estimate of the size of this colony, but daily counts on July 28, 29, and 30 resulted in counts of 17, 27, and 16 respectively. These data indicate that the daily population on these dates could be as high as 270 (adjusted by factor of 10), but surveyors guessed that they had counted most of the butterflies on the site in any one daily count. A minimum daily population during these dates was likely 50 individuals. If this was prior to the peak, then peak numbers would have been higher.



### *All years.*

Past population estimates of the Uncompahgre fritillary have taken various forms including estimates of peak daily population (Gall and Sperling 1980), absolute abundance (Gall 1984, Britten 1991), and population index values (Seidl 1995). Additionally, population estimates are lacking for many years in the early 1980's when decline is presumed to have taken place. This has confounded attempts to precisely define any trends in the population sizes of the various colonies, but severe low populations in 1988 and 1989 (Brussard and Britten 1989) and subsequent reports of high numbers (Seidl 1995, Seidl and Opler 1995) are enough to reveal a general increasing trend in the early 1990's that continued in 1995.

### UP1

| even years | population value  | type of estimate      | source                     |
|------------|-------------------|-----------------------|----------------------------|
| 1978       | "several hundred" | daily population      | Gall and Sperling 1980     |
| 1980       | 750-850           | absolute brood size   | Gall 1984                  |
| 1982       | 500               | absolute brood size   | Interagency Agreement 1985 |
| 1984       | N/A               |                       |                            |
| 1986       | N/A               |                       |                            |
| 1988       | 208               | absolute brood size   | Brussard and Britten 1989  |
| 1990       | 0                 |                       | Seidl and Opler 1995       |
|            | inadequate search |                       |                            |
| 1992       | 704               | population index      | Seidl 1995                 |
| 1994       | 808               | population index      | Seidl 1995                 |
| odd years  |                   |                       |                            |
| 1979       | 150-180           | peak daily population | Gall and Sperling 1980     |
| 1981       | present           |                       | U.S. Forest Service 1985   |
| 1983       | few present       |                       | U.S. Forest Service 1985   |
| 1985       | N/A               |                       |                            |
| 1987       | 0                 |                       | Brussard and Britten 1989  |
| 1989       | N/A               |                       |                            |
| 1991       | 0                 | population index      | Seidl 1995                 |
| 1993       | 1384              | population index      | Seidl 1995                 |
| 1995       | 6682              | population index      | this report                |

## UP6

| even years       | population value | type of estimate | source                    |
|------------------|------------------|------------------|---------------------------|
| 1988             | 2 or 6           | total observed   | Brussard and Britten 1989 |
| 1990             | N/A              |                  |                           |
| 1992             | 292              | population index | Seidl 1995                |
| 1994             | 192              | population index | Seidl 1995                |
| <b>odd years</b> |                  |                  |                           |
| 1987             | 3 or 4           | total observed   | Brussard and Britten 1989 |
| 1989             | N/A              |                  |                           |
| 1991             | 4                | total observed   | Seidl 1991                |
| 1993             | 1612             | population index | Seidl 1995                |
| 1995             | 1979             | population index | this report               |

## RC1

| even years       | population value | type of estimate    | source                    |
|------------------|------------------|---------------------|---------------------------|
| 1982             | 1000-1500        | absolute brood size | U.S. Forest Service       |
| 1984             | N/A              |                     |                           |
| 1986             | N/A              |                     |                           |
| 1988             | <492             | absolute brood size | Brussard and Britten 1989 |
| 1990             | 412              | population index    | Seidl 1995                |
| 1992             | 408              | population index    | Seidl 1995                |
| 1994             | 1112             | population index    | Seidl 1995                |
| <b>odd years</b> |                  |                     |                           |
| 1983             | present          |                     | U.S. Forest Service 1985  |
| 1985             | N/A              |                     |                           |
| 1987             | 250-300          | absolute brood size | Brussard and Britten 1989 |
| 1989             | N/A              |                     |                           |
| 1991             | 996              | population index    | Seidl 1995                |
| 1993             | 1384             | population index    | Seidl 1995                |
| 1995             | 11499            | population index    | this report               |



# INVENTORY

## Methods

The methods used in this search for the Uncompahgre fritillary attempted to systematically inventory a given area by designating survey areas that conformed to the general definition of the species' habitat, north through east aspects on slopes above 12,000 ft. (3658m). Subsequently, the highest priority survey areas were determined and as many as possible were visited. Presence or absence of the Uncompahgre fritillary as well as measures of the habitat suitability were recorded.

- Determined which general areas were the highest priority for 1995. The San Miguel Mountains, La Garita Mountains, Mt. Ouray and Bent and Carson Peaks were chosen based on the recommendations of previous researchers (Seidl 1993), and consultation with the Recovery Team. It is recognized that even the sum of these areas is only a fraction of the potential range of *B. acrocnema*.
- Designated survey areas within these regions. Previous searches that identified suitable habitat or reported sightings of *B. acrocnema* were essential to this effort. These areas were included as high priority search areas and, importantly, the mapping of suitable and occupied habitat allowed for aerial photographic interpretation of this habitat type and identification of other suitable sites. Additional survey sites were chosen by inspecting all north through east aspects above 12,000 feet within the given search region on aerial photographs (NAPP color IR 1:40,000 or natural color 1:40,000). Areas that appeared similar to the known occupied and suitable sites, generally mesic but with sparse ground cover (a sort of faded red color on IR photos) were then mapped. Each survey site was given a sequential number code based on the name of the topographic map it is located on (i.e. SP1 for Stewart Peak 1). These sites were numbered, and notes were kept regarding known information and aerial photograph inspection of each site. These sites were prioritized by previous sightings, size or extent of apparently suitable habitat, maximum elevation of the survey site, and a subjective judgment regarding the apparent "quality" of the site.
- Trained volunteer field crew. Volunteers met in Lake City in early July. Training took place at the known colonies so that surveyors could familiarize themselves with identification of *B. acrocnema*; look-a-like species *Euphydryas anicia* (Anicia checkerspot), *Boloria freija* (Freija's fritillary), and *B. titania* (Purple lesser fritillary); and any other butterflies that were flying. Identification of the host plant *Salix nivalis* and its look-a-like *S. arctica* were demonstrated. Survey forms, mapping, and general safety were also discussed.



- Conducted ground surveys. Each site was as thoroughly searched as possible. Protocol for searches followed that designated by the U.S. Fish and Wildlife Service. They were only conducted under favorable flight conditions of direct sun and minimal wind. All suitable habitat (north through east aspects above 12,000 ft. with patches of *Salix nivalis*) was marked on a 1:24,000 topographic map and a survey form was completed for all visited survey areas. This form (attached) contains information regarding the dates visited and the conditions at the time, presence or absence of *B. acrocnema*, presence or absence of *Salix nivalis*, presence or absence of *Trifolium* spp. (see Britten and Riley 1994), and notes regarding disturbance features and habitat description.
- Revisited sightings for verification. Sightings by field volunteers were revisited by trained field staff for further verification. Photographs were taken of the butterflies at the colony to document the occurrence.
- Established transects at new colonies. As field time allowed, transects were established and counted at newly confirmed colonies.

## Results

The search for additional colonies of *B. acrocnema* was very successful in 1995. Sightings reported by Brussard and Britten (1989) at Alpine Gulch (AG2) and Baldy Chato were revisited and significant sized colonies were found at each. A third colony near Baldy Cinco, located through the potential habitat analysis outlined above, was also discovered in the La Garita Range.

Searches elsewhere were hampered by the late snowpack and the extra work associated with verifying and monitoring the newly confirmed colonies. Some very promising habitat patches were visited and mapped however, helping to prioritize future searches in these areas.

In preparation for these surveys, potential habitat (based on aerial photograph inspection) was mapped for the entirety of the La Garita and San Miguel ranges and most of the area around Bent Peak, Carson Peak, and Pole Creek Mountain west to Howardsville.

### *La Garita Mountains.*

The La Garita Mountains were the primary focus of our search in 1995, and were the most rewarding. The La Garita Mountains are a rugged range that lies near the center of the San Juan volcanic field, falling into Hinsdale, Mineral, and Saguache Counties. The high crest of the range forms a part of the Continental Divide, separating the Gunnison and Rio Grande watersheds. The range extends from Spring Creek Pass on the west along the Divide to the Cochetopa Hills. The highest elevations are in the group of high peaks toward the eastern end of the range: San Luis Peak (4274m, 14,014ft.), Organ

Mountain (4,206m, 13,801ft.), Baldy Alto (4,175m, 13,698ft.), Stewart Peak (4,263m, 13,983ft.), and Baldy Chato (4,085m, 13,401ft.). Other high summits of note occur west of this group including Baldy Cinco (4,079m, 13,383ft.) at the western terminus of the range, La Garita Peak (4,181m, 13,710ft.) to the east, and many unnamed peaks over 4000m along the crest. The portions of the range that are high enough to hold potential *B. acrocneuma* habitat are found between Baldy Cinco and La Garita Peak (near Halfmoon Pass). The slopes north of the crest are generally steep glacial cirques that contain the majority of suitable *B. acrocneuma* habitat in the range. The southern slopes are generally more xeric due to their aspect and exposed topography and contain potentially suitable habitat only on high leeward (east) slopes.

Searches here were conducted from July 17 (first emergence at known colonies) to August 5. In that time, two teams conducted 30 surveys at 14 potential sites. All sites visited contained good potential habitat, and two of them contain *B. acrocneuma* colonies. Only one of these sites could be eliminated following site visit since it was found to be lacking the hostplant. Many of the most promising sites were visited, but several will require revisits to complete the butterfly surveys. Several large potential sites have not been visited. Areas visited that were confirmed to contain good potential habitat include the following:

- Headwaters of Mineral Creek. This area appears to locally support more mesic conditions, and *S. nivalis* is abundant in all areas surveyed. Potential sites are large and reach elevations over 13,000ft. (3,950m). Some of the most promising sites here were not surveyed.
- Western headwaters of Cascade Creek. This area forms the next major drainage west of Mineral Creek and supports similar mesic habitats. Areas are large, appear to retain relatively late-season snow, and reach high elevations (3,950m, 13,000ft.). Revisits to these sites are warranted.
- Headwaters of Spring Creek. The northeast-facing slopes at the head of this drainage were found to contain good potential habitat for similar reasons, but is smaller than the sites in Cascade Creek.
- San Luis Peak group. The several peaks that form the remnants to the San Luis caldera represent the highest continuous alpine habitat in the range. Although this area has been searched more than the rest of the range, the presence of such large expanses of potential habitat likely warrant further searching.
- La Garita Peak and Benito Lake. This area represents the eastern extent of likely *B. acrocneuma* habitat in the range. Sites here were not visited, but their high elevations (4,181m, 13,710ft.) and apparent mesic conditions are appealing.



### *San Miguel Mountains.*

The entirety of the San Miguel Mountains were designated as a search area for 1995. Extensive suitable habitat had been reported from the area of, especially the area near El Diente Peak and Lizard Head Pass (Seidl 1993).

The bulk of the high elevation habitat that potentially supports *B. acrocnema* is found on only two 7.5' topographic quadrangles: Mount Wilson and Dolores Peak. Through the aerial photograph inspection, suitable habitat was identified throughout the range. Only small patches appear to exist on the north and east slopes of Lizard Head and Sunshine Mountain. Large expanses of suitable habitat are found further west. The Cross Mountain-Gladstone Peak cirque appears to have many patches of habitat, some quite large. The cirque between Gladstone Peak and Wilson Peak also shows promise for large areas of habitat. The north and east slopes of the high peaks of El Diente, Wilson Peak and Mount Wilson are generally too rocky and active to support large areas of alpine vegetation. However, Navajo Basin, which lies below the northwest slopes of Mount Wilson contains a very large patch of mesic alpine vegetation that may be suitable in spite of its westerly aspect. The extreme western extension of this range at Dolores Peak and Middle Peak appears to contain only small patches of suitable habitat on the large northeast flank of the two mountains.

Searches in this area were minimal in 1995 due to a persistent snow cover that stayed later than the snow in the eastern San Juan Mountains near the known colonies. Very few of the identified survey areas were free of snow, even in late July. Our volunteers persevered, however, and were able to visit 11 survey sites. The presence of *Salix nivalis* was confirmed at six of these sites, indicating that habitat is present that may support *B. acrocnema* on a year with less snow, or perhaps later in the season. Three of the visited sites were entirely snow covered and could not be inspected at all, two survey sites were found to be unsuitable.

These surveys were able to confirm the presence of suitable habitat in three of the most promising areas in this range:

- Cross Mountain. The northeast slopes of this mountain are part of the cirque between Cross Mountain and Gladstone Peak. Elevations range from 12,000-12,500 ft. (3658m - 3810m). The area, while mostly snow covered, had high density of *Salix nivalis* in melted areas and *Trifolium* spp. were confirmed to be present. The full extent of this habitat could not be determined due to snow.
- Gladstone Peak. The cirque between Gladstone Peak and Wilson Peak was similarly confirmed to contain suitable habitat above and to the southwest of the small lake at 12063 ft. Elevations range from 12,000-13,000 ft. (3658m - 3962m). Most of the site was still snow covered, but *Salix nivalis* was found in moderated densities. Cross Mountain and Gladstone Peak are both within the proposed Wilson Meadows Research Natural Area (J. Coles, pers. comm.).



- Navajo Basin. This site was visited in 1981 by field crews from Western State University, in 1993 by Terry Ireland (USFWS), and again in 1995 by our crew. All report extensive suitable habitat with large areas of *Salix nivalis*, but no *B. acrocnema* have been observed. Conditions during our 1995 visit were not suitable for *B. acrocnema* flight due to the overall delay in seasons this year. The site has notably never been surveyed on an even year. This site may be atypical for *B. acrocnema* habitation due to its mostly westerly aspect. However, it is apparently well sheltered and moisture may be equivalent to that on north through east slopes that typically support the species. This area is apparently heavily used by backpackers and climbers.

#### ***Bent/Carson Peaks and Pole Creek Mountain.***

The area around Bent Peak and Carson Peak was noted as a high priority area by Seidl (1993), and was included in our search areas for 1995. Inspection of the maps and aerial photographs of the area indicated that this area was contiguous with large areas of potential habitat near Pole Creek Mountain. This analysis included this the area from Bent Peak south to Pole Creek Mountain and west to Howardsville. This area is contained on the Pole Creek Mountain and Howardsville 7.5' quadrangles.

These mountains lie approximately 9 km due south of Redcloud Peak. Bent and Carson Peaks are on the ridge separating the Gunnison and Rio Grande watersheds, while Pole Creek Mountain lies entirely east of the Continental Divide in the headwaters of the Rio Grande. Aerial photograph inspection of this area was completed and resulted in the identification of many very large areas of apparently suitable habitat throughout this high and rugged region.

Searches in this region were also minimal due to the late season and the need to verify newly discovered populations elsewhere. In fact, the searches in this area mostly took place before the flight began at the known colonies, allowing us to map habitat but probably not to locate additional colonies. Four sites were visited, and although no *B. acrocnema* were found, large areas of suitable habitat were confirmed

- Carson Peak. The northeast bowl of Carson Peak appears ideal for *B. acrocnema*. This area contains high densities of *Salix nivalis* over much of the bowl. *Trifolium* spp. were also present, and flower density was noted to be moderate. Much of the bowl seems to be kept moist by late-season snowpack below the peak.
- Bent Peak. The northeast bowl of this peak is similar to that of Carson Peak, but is slightly smaller in the extent of *Salix nivalis* cover, although the true extent of the habitat could not be discerned due to late snow cover that obscured the site. *Trifolium* spp. were present and flower density was moderate.
- Coney Point. This small peak on the Continental Divide lies approximately 3km east of Bent Peak. We visited the bowls south and southeast of the peak. Although late

snow was still a problem, *Salix nivalis* was present in both areas, and suitable habitat appeared to exist under the snow. *Trifolium* spp. were present in both of these sites. A number of unmapped but active off-road vehicle tracks dissect the alpine areas above Carson, including these potential habitat sites.

#### ***Mount Ouray.***

Mount Ouray lies at the southern-most extension of the Sawatch Mountains. South of Monarch Pass, this mountain and the adjacent alpine areas appear, from topographic map inspection only, to potentially hold extensive habitat suitable to *B. acrocneuma*. Primarily, however, it is the still unverified report of a *B. acrocneuma* sighting on the mountain that led to its inclusion in high priority survey areas.

The shortened survey period and the need to verify new colonies did not allow us to visit this area in 1995.

#### ***Redcloud Peak.***

Searches in the Redcloud Peak vicinity focused on areas that had previously been identified as potential *B. acrocneuma* habitat including points where this butterfly had been observed in 1987-1988 (Britten and Brussard 1989). The South Fork (of Silver Creek) headwaters area was searched. Similarly the observation on the steep north slope of Redcloud was also searched to no avail. The Alpine Gulch observation (AG2 in Britten and Brussard 1989) proved to be supporting a substantial colony in 1995. Transects were established immediately and daily counts were made throughout the flight period (see Monitoring Results section). Other identified potential habitat was not revisited.

#### ***Uncompahgre Peak.***

Searches in the Uncompahgre Peak area focused on previously identified potential habitat (Brussard and Britten 1989). Although most of the identified patches were traversed on almost every day the known colonies were visited, we did not observe *B. acrocneuma* outside of the known colonies (see Results).



## RECOMMENDATIONS

Efforts to conserve this species continue to be warranted. Although the species has apparently experienced a recent increase in numbers, and is now known to occupy more sites, it cannot be said to be secure or no longer in danger of extinction. Indeed, the same concerns that led to the species endangered designations persist even if there is now a slightly wider margin keeping it from extinction. Protection of each of the sites supporting this species should remain a high priority, as should continued monitoring and inventory (Fish and Wildlife Service 1994).

Efforts believed to be necessary to the conservation of this species are well summarized by the Uncompahgre Fritillary Recovery Plan (Fish and Wildlife Service 1994). These measures need to be continued. Specific recommendations from our experience are given below:

1. Continue monitoring efforts. The location of additional colonies makes continued monitoring especially important. The comparison of population trends among sites will provide a means to better distinguish the potential causes of fluctuation. Additionally, it may be possible to refine monitoring techniques in ways that will require less intense effort, yield less subjective results, and still be comparable to data collected by past research. A closer approximation of Thomas' (1984) method, which obtained population estimates with only a single daily sample at most sites, may be possible. The recently developed "distance sampling" techniques by Buckland et al. (1993) also may provide an applicable non-intrusive method of estimating absolute population sizes. Many other successful methods have potential for improving this monitoring effort.

2. Continue searches. Searches in 1995 were the most successful since those in 1987-88. Given the amount of potential habitat in the San Juan and southern Sawatch Mountains, it is still reasonable to assume that additional colonies can be located. The systematic approach used in 1995 worked well and should be continued. As more searches are completed, it will be increasingly important the areas searched are carefully recorded and tracked in an orderly fashion.

Further searches show promise in virtually any alpine region in the San Juan Mountains. However, some priorities can be set based on topography and maximum elevations, the proximity to known populations, and partial survey efforts already completed. The following is a running list of some areas that should be searched in an approximate order of high to low priority.

- La Garita Mountains. The discovery of two colonies in this range indicates that environmental factors in this eastern extension of the San Juan Mountains may be overall favorable to *B. acrocnema*. Several areas of good potential habitat have been identified but not thoroughly surveyed. Additionally, large areas of potential habitat very near the new colonies remain unsurveyed.



- Bent/Carson Peaks and Pole Creek Mountain. The identification of large areas of good potential habitat, the relative proximity to Redcloud Peak, and a similar position relative to the San Juan massif as other known colonies combine to suggest that this area may be promising. Thorough butterfly surveys remain to be completed although of potential habitat mapping of the area is complete.
- Mount Ouray. Reports of *B. acrocneuma* from the bowl north of the peak, combined with the suggestion by J. Scott of the species' range extending into the southern Sawatch Mountains (Britten and Brussard 1989) imply that this area should be searched. Confirmation in this mountain range would significantly expand the search area for the species.
- Cinnamon Pass. This area is relatively close to Redcloud Peak, has been confirmed as having extensive potential habitat, and sightings have been reported here from two separate sources (P. Opler, pers. comm., Rogers 1994). Other than late-season searches in 1994 (Rogers 1994), apparently very little official searching has been carried out in this area.
- San Miguel Mountains. This area has been searched and recommended as containing ample potential habitat from several search efforts including ours in 1995.
- Rio Grande Pyramid. This feature of the southeastern San Juan Mountains stands out as one of the highest elevations in the San Juan Mountains, its relative position on the eastern edge of the massif is similar to that of Uncompahgre and Redcloud, and the northeast slopes appear to offer large areas of potentially suitable habitat.
- Needles, West Needles, and Grenadier Mountains. These are perhaps the most rugged and remote peaks of the San Juan Mountains. However, they obviously contain extensive areas of very high elevation. Casual inspection of topographic maps indicates that while much of the range is very steep, some large alpine basins exist that may become high priority search areas.
- Red Mountain Pass. This is an area of the central San Juan Mountains that may be relatively easily surveyed due to ample road access. Large areas of alpine habitat hold good potential for *B. acrocneuma*, in spite of widespread mining impacts. Also, a potentially associated alpine relict butterfly *Erebia theano demmia* (Theano's alpine ssp.) is already known from this area.
- Mount Sneffels area. An impressive amount of the BLM property in this area has been searched without observations of *B. acrocneuma* (Rogers 1994). However, much good potential habitat was identified and this area still holds good potential for the species.



3. Encourage further scientific research. Even in times of funding constraints, it may be possible for the agencies involved in the conservation of *B. acrocnema* to suggest and encourage non-intrusive research on this species. Interesting and potentially useful questions remain to be answered. If we have learned anything, it is that we do not know enough.

## Protection and management of sites.

### *Uncompahgre Peak site.*

Conservation efforts at the site should continue to make protection of *B. acrocneuma* the primary goal. However, the full value of the site is underestimated if only this species is considered. The presence of other rare butterflies (*Erebia theano demmia*, a subspecies of Theano's alpine that is also endemic to the San Juan Mountains, and *Oeneis taygete*, the white-veined arctic) (Gall and Sperling 1980, Opler 1988, A. Ellingson pers. obs) imply that this area supports a unique assemblage of species that occur throughout the bowl southeast of the peak.

### Status:

This site is the best known of the *B. acrocneuma* sites, and has received the most directed conservation efforts. The area was included in the Big Blue Wilderness Area prior to discovery of *B. acrocneuma*, and part of this area is also a Registered State Natural Area (Colorado Natural Areas Program). Furthermore, the USFS has instigated a ban on collecting any butterflies within a large area surrounding the site and adjacent habitats.

The discovery of UP6 in 1987 expanded the area of the bowl that supported this butterfly well beyond the limits of the Registered State Natural Area, and even exceeds the bounds of the Big Blue Wilderness Area by less than 100m. Additionally, the area occupied by UP1 in 1995 was larger than previously recorded and it too crosses the bounds of the Registered State Natural Area that was designed to protect this colony.

Although there is a USFS collecting ban and stipulations of the U.S. Endangered Species Act forbid it, removal of *B. acrocneuma* from this site by unscrupulous collectors has recently occurred (P. Opler. pers comm.), but likely at a rate reduced from that prior to listing. The publicity regarding the precise location of the type locality (UP1) may make it the most heavily collected of any of the *B. acrocneuma* colonies.

The grazing of sheep has also been witnessed within the UP1 colony (A. Seidl, pers. comm.) in spite of regulations for its prohibition.

A further consideration related to the current status of the site is the increasing number of recreational hikers and climbers that visit the site throughout the summer. This is one of the most popular trails on the Uncompahgre National Forest, and visitor use here is increasing every year. The result is a trail that is overused and difficult to maintain. The length of the trail is rutted and often braided into three or more tracks. Stream crossings are eroding and late-season snow pack has forced hikers off the trail to form new paths around the edges of the melting snow. Most important, the trail crosses twice through the *B. acrocneuma* colony. Where the trail dissects the upper portion of the colony it remains relatively dry and is not badly eroding. In the lower portion, however, the trail passes through the colony before gaining the western ridge. Here the tundra is



saturated by melt from the snowfield that forms just below the ridge. While this snowfield is present (through at least August in 1995) surface flows are substantial. The trail also becomes saturated and is therefore rarely used by any hiker through this portion (A. Ellingson, pers. obs.). This results in trampling of the tundra within approximately 2m of either side of the trail. As use increases, it is likely that the trail will widen, destroying habitat currently occupied by *B. acrocnema*. The trail also alters the flow of surface water across the colony site by channeling the flow within the trail and altering the moisture of microhabitats down the slope.

#### Protection recommendations:

While past protection efforts at this site have been wisely implemented, and may have been responsible for the recent increase in numbers, it appears that long-term protection may require the consideration of an area larger than the colonies themselves, and that extends beyond existing land designation boundaries. We suggest that the area here referred to as the Uncompahgre Peak site (see **Map 1**) is an appropriately defined area for protection efforts.

There are several ecological considerations which enforce this suggestion. First is the apparent dynamic nature of the *B. acrocnema* colonies and their tendency to shift the location of existing colonies, and possibly to colonize nearby areas. The upper portion of UP1 has shifted its precise area of occupancy (A. Seidl, pers. comm.), and the expansion into the lower portion of UP1 may in a sense be a short-distance colonization event if not a simple expansion of the upper portion of the colony. Similarly, the existence of a second colony within close a distance to UP1 may have been the result of colonization. The area contained within the Uncompahgre Peak site contains all of the adjacent potential habitat that is not separated by a major landform barrier, including all but one of Britten and Brussard's (1989) subsites, that are conceivably open to colonization by *B. acrocnema*.

Along these lines, Erhlich and Murphy (1987) state that an important factor in the long-term persistence of *Euphydryas editha bayensis* (Bay checkerspot) was the habitat heterogeneity at the site. This site contains considerable habitat heterogeneity within the range habitable to *B. acrocnema*. *Salix nivalis* habitat, taken as the broadest approximation of this species' niche, is found within the bowl in a variety of environmental settings (differing in slope, aspect, plant compositions, snow accumulation, exposure, moisture, etc.), and even a narrower definition of potential habitat reveals many differing patches within the bowl. These considerations suggest that protection of the whole southeast bowl of Uncompahgre Peak would be prudent.

Perhaps the most immediate measure would be to expand the Uncompahgre Fritillary Registered State Natural Area to coincide with this boundary. However, effective protection will require additional actions such as those named below.

#### Management recommendations:



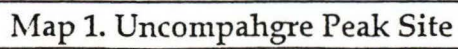
Again, past management of the Uncompahgre colonies has been well implemented and may have played a role in the species' apparent 1990's recovery (Seidl and Opler 1994, Britten et al. 1994b). Efforts to counter potential threats should continue.

Continue to enforce collecting ban. The precise location of the type locality has been publicly available since 1980, and this is now only one of two locations known to the general public. This is likely to lead most potential collectors to this site. Although enforcement in such a remote area is difficult, the continued presence of researchers or trail crews will likely serve as a deterrent.

Relocate or improve trail. As visitor use continues to increase, degradation of the occupied *B. acrocne* habitat by trampling, altered drainage, and trail erosion will become more of a concern. It is prudent to work proactively to address this potential threat. The trail may be relocated only 50m to the southeast (to the position as it appears on the 7.5' quad) into dry grassy knoll with little if any potential habitat. Part of such a bypass already exists as the trail that continues over the ridge to the El Paso Creek drainage. Unfortunately, it is likely that there will be a lingering problem of the old trail offering a more direct route and still being used. The alternative is to improve the section of trail that passes through the colony which is approximately 100m in length. The addition of stepping stones may provide a means for hikers to stay on the trail. An elevated walkway of wooden planks may provide footing and allow for a more natural drainage underneath the boardwalk. In any case, trail maintenance at Uncompahgre Peak needs to be a high priority to protect this habitat.

Additional signage, emphasizing the need to stay on the trail when visiting Uncompahgre Peak, may also be helpful. In fact, consideration should be given to the fact that the location of the main colony at Uncompahgre Peak is common knowledge and that at least some threats may be best countered by educating and involving the visiting public. Our experience in the field was that many people are very interested in knowing more about the natural values of the place they are visiting. Signs to stay on the trails could be more effective if they also were interesting and explained why. Interpretive signage at trail heads that discusses the unusual alpine environment, the uniqueness of this site, and the great need to stay on the trail and not disturb the butterfly or its habitat may be one of the most efficient options given the increasing numbers of people visiting the area and the difficulties in enforcement.





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## *Redcloud Peak site.*

### Status:

Like Uncompahgre Peak, Redcloud Peak is also a very popular destination for hikers and climbers. The trail here has been relocated from its original position which passed through a major portion of the colony, however, use of the old trail appears to remain high, especially by hikers traveling downhill. Late snow melt in 1995 meant that the new trail was not passable as easily as the former, more direct route. Also, it is not obvious that the old trail is closed while descending from the peak. Currently, signage here is minimal: a single sign at the bottom of the trail closure reads "<-- Trail." More effective signage, even if it did not mention the butterfly, could be more effective in encouraging use of the new trail.

The existing BLM prohibition against collecting butterflies is not posted. While we do not have any accounts of illegal collecting at Redcloud Peak, the general location of this colony is also considered public knowledge as it has appeared in peer-reviewed literature. This site is therefore at risk of receiving excess collecting pressure.

The entirety of the Redcloud site, including the Alpine Gulch colony, are within an area designated by the BLM as and Area of Critical Environmental Concern (ACEC).

Large numbers of elk were observed on several occasions in 1995, and sometimes had to be chased off the colony before transect counts could be made. The impact of high elk use is not known, but sites such as Alpine Gulch may provide opportunity for comparative studies to this effect.

### Protection recommendations

Long term persistence of the Redcloud and Alpine Gulch populations will be favored by the protection of an area larger than that which is occupied the colonies in any one year. The need to maintain habitat that is not currently occupied is made more evident by this years confirmation of a substantial colony in Alpine Gulch. Similarly, the observations of *B. acrocnema* individuals on other habitat patches (Brussard and Britten 1989) suggest that dispersal and potentially colonization may be a relatively common event. Habitat heterogeneity may also be related to long term persistence in butterflies (Ehrlich and Murphy 1987) and would be enhanced by a large protected area. **Map 2** indicates an area that includes both colonies and all identified habitat in the vicinity of these colonies as well as the points of individual sightings in potential habitat but outside of known colonies. We recommend that protection efforts attempt to include the whole of this site.

The potential for the development of mineral resources within the site is not fully known to the authors, but mining activities and proposals in the area suggest that this could some day be a real threat. Alpine Gulch, in particular, was a part of a recent large-scale mining proposal at Red Mountain (J. Capodice, pers. comm.). Similar proposals in



the future would not be prevented by the site's status as an ACEC, but would be subject to Section 7 review (under the Endangered Species Act) by the USFWS.

#### Management recommendations

Notice of the collection prohibition at should be posted at trailheads that access the site (Silver Creek and Alpine Gulch).

As a precautionary measure, continue to restrict the amount of sheep grazing sustained by the site, especially during the flight season (when nectar sources may be reduced by heavy grazing).

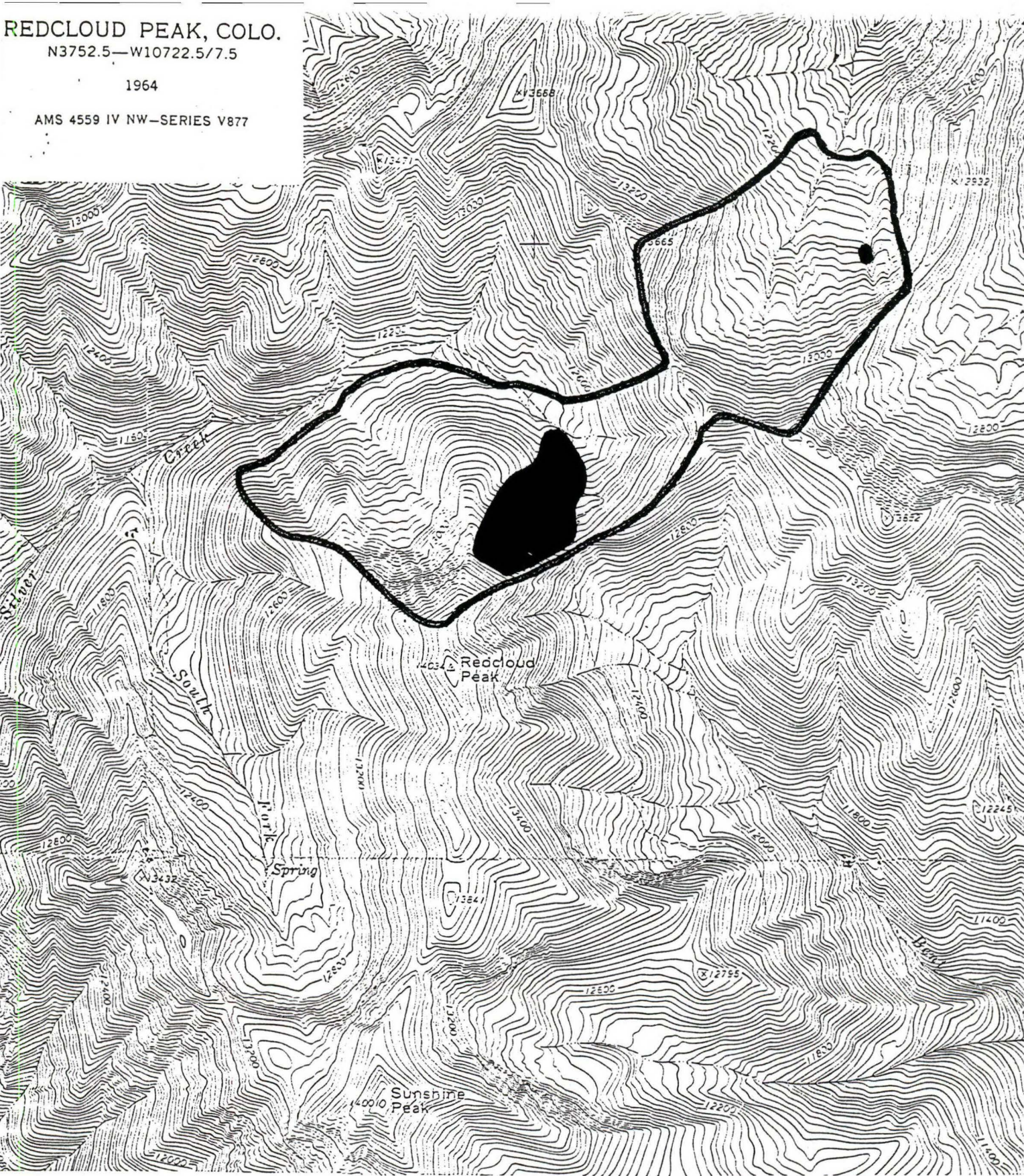
Traveling on-trail while visiting the site needs to be increased. Signs which explain the fragile and unique nature of this alpine area in particular may increase voluntary compliance as would more effective signing of the new route. Downhill traffic seemed to be most common through the site, indicating that signage on the descent route above the colony may be beneficial.



REDCLOUD PEAK, COLO.  
N3752.5—W10722.5/7.5

1964

AMS 4559 IV NW—SERIES V877



Map 2. Redcloud Site

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### *Baldy Chato site.*

#### Status:

This occurrence and recommended site boundaries fall entirely within the La Garita Wilderness Area (Cebolla Ranger District, Gunnison National Forest). The area contains vast alpine habitat that is minimally impacted and potentially threatened only by natural stochastic events, making it very important in future interpretations of population fluctuations.

Visitor use appears to be very low since there are no major recreational attractions such as high summits or interesting climbs. The trail used to access the site is lightly used and overgrown in spots. Furthermore, it passes nearly 2km south of the colony location.

Past sheep grazing in the area appears likely, as signs of intensive grazing were observed in other parts of the La Garita Mountains (especially Snow Mesa). However, the grazing allotment at this site is not active at this time (W. Reinmuth, USFS, pers. comm.)

Our observations, and those of previous researchers (T. Ireland, USFWS, pers. comm.) indicate that elk use this area, including that occupied by the colony, on a regular basis in the summer months. Large herds were observed, and signs (tracks and scat) were abundant on the site. The effects of elk browsing on this habitat are not known.

This area, and the La Garita Wilderness Areas in general, have been found to contain low potential for mineral development (Steven and Bieniewski 1977).

#### Protection recommendations

Like the above sites, protection that is restricted to only the precise area occupied by the colony is likely to be inadequate for long-term persistence of the population. We have recommended a boundary for the Baldy Chato Site (see **Map 3**) that considers the same factors mentioned in the recommendations for the sites above. The site is designed to protect contiguous habitat potentially available for colonization and to contain sufficient habitat heterogeneity.

We recommend that some formal protection be given to this area that is beyond the existing wilderness designation. The very large and relatively unimpacted nature of this site suggests that it may be appropriate for USFS Research Natural Area designation. Similarly, the Colorado Natural Areas Program may wish to consider special designation of this area.

Imperative to the most effective protection of this colony is the continued secrecy regarding its location. Presently we can assume that collecting pressure has been minimal to non-existent since the location has not been publicized or made available to the butterfly collecting community (to the best of our knowledge). If the location were to become known, however, one would expect illegal collection as occurs at Uncompahgre Peak. As long as the location is not revealed, blanket collection bans such as that in place

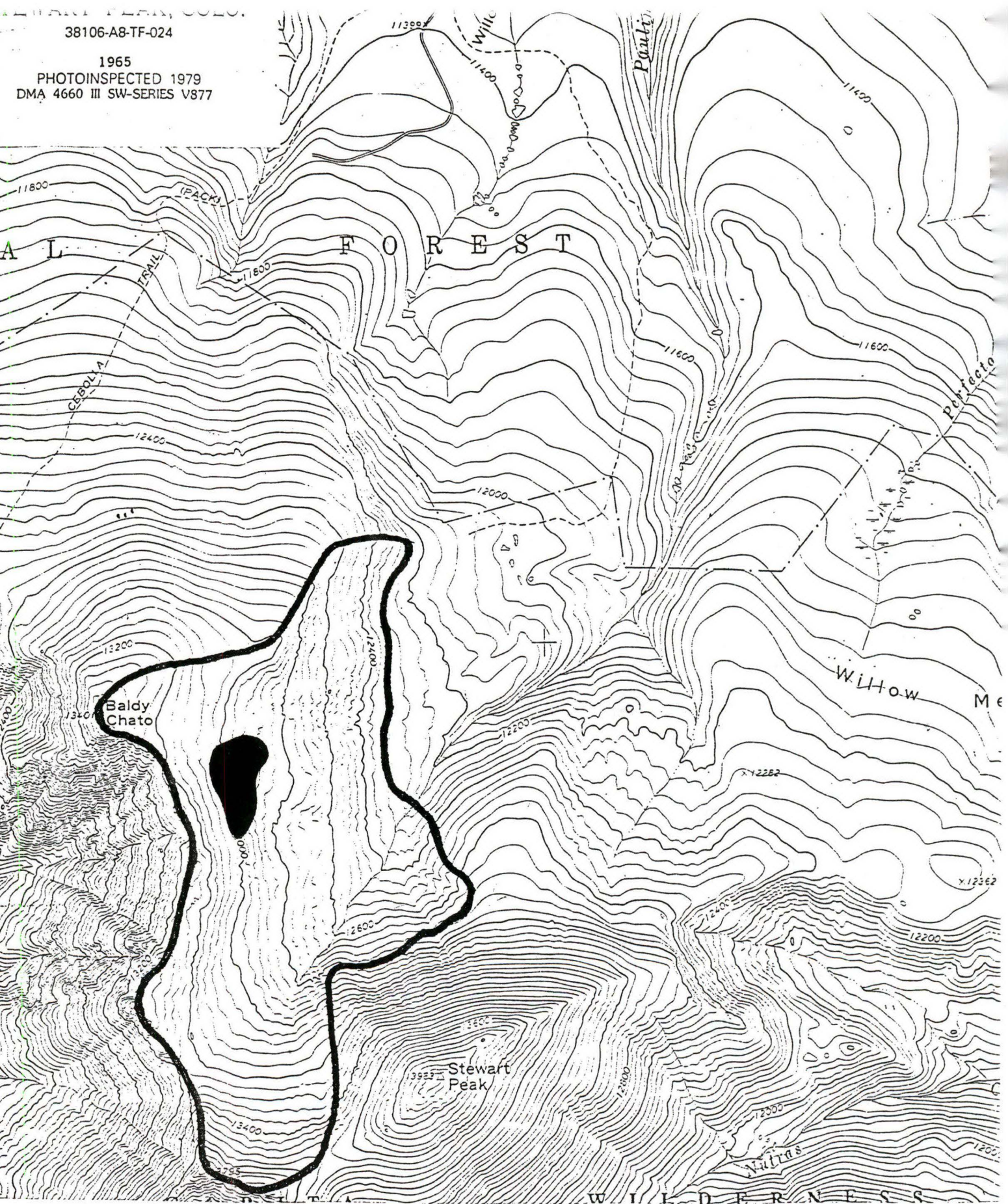
at Uncompahgre Peak will not be necessary. This concern should be addressed in any formal protective designation of the area by a public agency.

Management recommendations

At present, it appears that the system is naturally regulated and not in need of immediate management actions. It will be essential to initiate population monitoring efforts at this colony in order to determine if any management actions may be necessary.

If the area is allotted to sheep grazing, it may be prudent to at least limit the number of animal units in this area.





Map 3. Baldy Chato Site



## *Baldy Cinco site.*

### Status:

Like the Baldy Chato Site, this occurrence and recommended site boundaries fall entirely within the La Garita Wilderness Area (Cebolla Ranger District, Gunnison National Forest). The area contains alpine habitat that is minimally impacted and potentially threatened only by natural stochastic events, making it very important in future interpretations of population fluctuations.

Visitor use appears to be very low and there are no major recreational attractions such as high summits or interesting climbs. The Colorado Trail passes to the south on the other side of the Continental Divide, but visitor use of this site could not be detected.

Evidence of sheep grazing was not observed on the site, but is common, and intensive in areas, just across the Divide on Snow Mesa. The steeper terrain on this side of the Divide may discourage regular use by livestock.

This area, and the La Garita Wilderness Areas in general, have been found to contain low potential for mineral development (Steven and Bieniewski 1977).

The location of this colony has only been known to us since the summer of 1995 and it is probably safe to assume that its location is not known to the butterfly collecting public. Over-collection at this site is not currently a real threat.

Like the Uncompahgre Peak Site, this site also supports another rare butterfly species, *Oeneis taygete* (white-veined arctic), suggesting that this location has natural values beyond the presence of an endangered species.

### Protection recommendations

Like the above sites, protection that is restricted to only the precise area occupied by the colony is likely to be inadequate for long-term persistence of the population. We have recommended a boundary for the Baldy Cinco Site (see **Map 4**) that considers the same factors mentioned in the recommendations for the sites above. The site is designed to protect contiguous habitat potentially available for colonization and to contain sufficient habitat heterogeneity.

Formal protection, beyond the existing wilderness designation, may be appropriate. This site, and the colony it contains, are much smaller than those at Baldy Chato, making it less suitable for RNA designation. Since the site is largely unthreatened by deterministic factors, it may be sufficient only to retain secrecy of its location.

Imperative to the most effective protection of this colony is the continued secrecy regarding its location. Presently we can assume that collecting pressure has been minimal to non-existent since the location has not been publicized or made available to the butterfly collecting community (to the best of our knowledge). If the location were to become known, however, one would expect the potential for illegal collection as occurs at Uncompahgre Peak. However, the difficult access to this site is likely to discourage



visitors of any kind. As long as the location is not revealed, blanket collection bans such as that in place at Uncompahgre Peak will not be necessary.

#### Management recommendations

At present, it appears that the system is naturally regulated and not in need of immediate management actions. It will be essential to initiate population monitoring efforts at this colony in order to determine if any management actions may be necessary.

If the area is allotted to sheep grazing, it may be prudent to at least limit the number of animal units in this area.



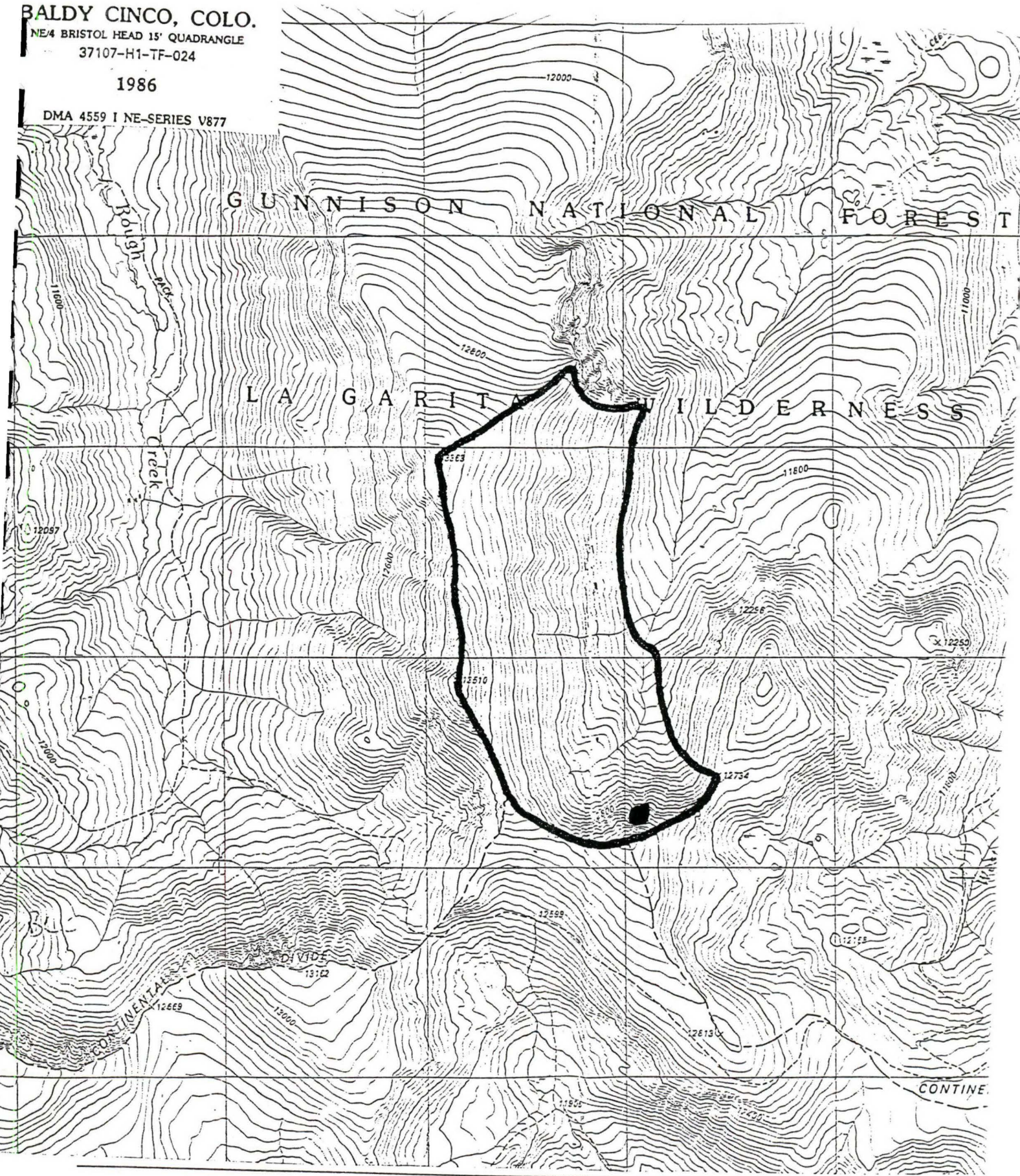
BALDY CINCO, COLO.

NE/4 BRISTOL HEAD 15' QUADRANGLE

37107-H1-TF-024

1986

DMA 4559 I NE-SERIES V877



Map 4. Baldy Cinco Site.

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